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DOE/MA-0064/4
Volume 3 of 7

Congressional Budget Request

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Energy Supply Research and Development

Volume 3

FY 1987

U.S. Department of Energy
Assistant Secretary,
Management and Administration
Office of the Controller

February 1986

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DOE/MA-0064/4
Volume 3 of 7

Congressional Budget Request

Energy Supply Research and Development

Volume 3

FY 1987

U.S. Department of Energy
Assistant Secretary,
Management and Administration
Office of the Controller
Washington, D.C. 20585
February 1986

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DEPARTMENT OF ENERGY
FISCAL YEAR 1987 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
VOLUME 3
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DEPARTMENT OF ENERGY

FISCAL YEAR 1987 CONGRESSIONAL BUDGET REQUEST

SUMMARY OF ESTIMATES BY APPROPRIATIONS

(in thousands of dollars)

	FY 1985 Actual BA	FY 1986 Estimate BA	FY 1987 Request BA
Appropriations Before The Energy and Water Development Subcommittees:			
Energy Supply Research and Development	1,967,490	1,696,298	1,254,162
Uranium Enrichment	237,956	190,512	---
General Science and Research	724,860	655,928	773,400
Atomic Energy Defense Activities ..	7,322,321	7,231,664	8,230,000
Departmental Administration	128,602	150,319	151,082
Alaska Power Administration	3,233	3,245	2,881
Bonneville Power Administration ...	284,771	330,000	276,100
Southeastern Power Administration .	35,744	---	19,647
Southwestern Power Administration .	31,208	29,191	25,337
Western Area Power Administration .	218,230	195,910	240,309
Western Area Power Emergency Fund .	---	---	---
Federal Energy Regulatory Commission	54,543	41,989	20,325
Nuclear Waste Fund	327,669	499,037	769,349
Geothermal Resources Development Fund	121	69	72
Subtotal, Appropriations Before the Energy and Water Development Subcommittees	$11,336,748	$11,024,162	$11,762,664

DEPARTMENT OF ENERGY
FISCAL YEAR 1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF ESTIMATES BY APPROPRIATIONS

(in thousands of dollars)

	FY 1985 Actual BA	FY 1986 Estimate BA	FY 1987 Request BA
Appropriations Before Interior and Related Agencies Subcommittees:			
Alternative Fuels Production	$ 1,169,895	$ ---	$ ---
Clean Coal Technology	---	---	---
Fossil Energy Research and Development	289,048	311,954	82,767
Naval Petroleum and Oil Shale Reserves	156,874	13,002	127,108
Energy Conservation	457,436	427,512	39,433
Energy Regulation	27,139	23,423	21,850
Emergency Preparedness	6,045	5,750	6,044
Strategic Petroleum Reserve	2,049,550	107,533	---
Energy Information Activities	60,919	57,724	59,651
Subtotal, Interior and Related Agencies Subcommittees	4,216,906	946,898	336,853
Subtotal, Energy and Water Development Subcommittees	11,336,748	11,024,162	11,762,664
Subtotal, Department of Energy	15,553,654	11,971,060	12,099,517
Permanent - Indefinite Appropriations:			
Payments to States	1,052	570	570
Total, Department of Energy	$15,554,706	$11,971,630	$12,100,087

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL STAFFING REQUEST
TOTAL WORK FORCE

	FY1985 FTE USAGE	FY1986 CONGR REQ	FY1987 -FY86	FY1987 CONGR REQ
ENERGY & WATER SUBCOMMITTEE				
HEADQUARTERS	4,865	4,965	-18	4,947
FIELD	9,133	9,185	111	9,296
SUBCOMMITTEE TOTAL	13,998	14,150	93	14,243
INTERIOR SUBCOMMITTEE				
HEADQUARTERS	1,353	1,304	-166	1,138
FIELD	907	896	-226	670
SUBCOMMITTEE TOTAL	2,260	2,200	-392	1,808
GRAND TOTAL	16,258	16,350	-299	16,051
ADJUSTMENT		-132	-198	-330
ADJUSTED TOTAL	16,258	16,218	-497	15,721

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL STAFFING REQUEST
TOTAL WORK FORCE

	FY1985 FTE USAGE	FY1986 CONGR REQ	FY1987 -FY86	FY1987 CONGR REQ
10:ENERGY SUPPLY RESEARCH AND DEV	937	934	-34	900
HEADQUARTERS	811	820	-28	792
FIELD	126	114	-6	108
15:URANIUM ENRICHMENT	69	66	1	67
HEADQUARTERS	58	55	1	56
FIELD	11	11	0	11
20:GENERAL SCIENCE AND RESEARCH	37	39	0	39
HEADQUARTERS	37	39	0	39
25:ATOMIC ENERGY DEFENSE ACTIVITI	2,618	2,702	131	2,833
HEADQUARTERS	496	518	9	527
FIELD	2,122	2,184	122	2,306
30:DEPARTMENTAL ADMINISTRATION	3,307	3,332	-5	3,327
HEADQUARTERS	1,721	1,726	0	1,726
FIELD	1,586	1,606	-5	1,601
34:ALASKA POWER ADMINISTRATION	37	38	0	38
FIELD	37	38	0	38
36:BONNEVILLE POWER ADMIN	3,510	3,480	0	3,480
FIELD	3,510	3,480	0	3,480
38:SOUTHEASTERN POWER ADMIN	38	40	0	40
FIELD	38	40	0	40
42:SOUTHWESTERN POWER ADMIN	186	186	0	186
FIELD	186	186	0	186
46:WESTERN AREA POWER ADMIN	1,181	1,160	0	1,160
FIELD	1,181	1,160	0	1,160
50:WAPA - COLORADO RIVER BASIN	219	219	0	219
FIELD	219	219	0	219
52:FEDERAL ENERGY REGULATORY COMM	1,617	1,659	0	1,659
HEADQUARTERS	1,617	1,659	0	1,659
54:NUCLEAR WASTE FUND	238	292	0	292
HEADQUARTERS	123	147	0	147
FIELD	115	145	0	145
56:GEOTHERMAL RESOURCES DEV FUND	2	1	0	1
HEADQUARTERS	2	1	0	1
65:FOSSIL ENERGY RESEARCH AND DEV	714	700	-161	539
HEADQUARTERS	151	135	-26	109
FIELD	563	565	-135	430
70:NAVAL PETROL & OIL SHALE RES	104	104	-9	95
HEADQUARTERS	23	23	0	23
FIELD	81	81	-9	72
75:ENERGY CONSERVATION	333	352	-134	218
HEADQUARTERS	208	227	-79	148
FIELD	125	125	-55	70
80:EMERGENCY PREPAREDNESS	74	71	0	71
HEADQUARTERS	74	71	0	71
81:ECONOMIC REGULATION	377	340	-50	290
HEADQUARTERS	377	340	-50	290
85:STRATEGIC PETROLEUM RESERVE	178	152	-32	120
HEADQUARTERS	40	27	-5	22
FIELD	138	125	-27	98
90:ENERGY INFORMATION ACTIVITIES	480	481	-6	475
HEADQUARTERS	480	481	-6	475
94:ADVANCES FOR CO-OP WORK	2	2	0	2
FIELD	2	2	0	2
GRAND TOTAL	16,258	16,350	-299	16,051
ADJUSTMENT		-132	-198	-330
ADJUSTED TOTAL	16,258	16,218	-497	15,721

DEPARTMENT OF ENERGY

Proposed Appropriation Language

Energy Supply, Research and Development Activities

(Including Transfer of Funds)

For expenses of the Department of Energy activities including the purchase, construction and acquisition of plant and capital equipment and other expenses incidental thereto necessary for energy supply, research and development activities, and other activities in carrying out the purposes of the Department of Energy Organization Act (Public Law 95-91), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction or expansion; purchase of passenger motor vehicles (not to exceed [17] 18 for replacement only), [$1,989,671,000] $1,254,162, to remain available until expended [of which $200,000,000]; in addition, $584,158,000 shall be derived by transfer from Uranium Supply and Enrichment Activities provided in prior years[, and of which $17,400,000 shall be derived by transfer from Operation and Maintenance, Southeastern Power Administration; and of which $25,000,000 shall be available only for construction of]: Provided, That funds available under this head in Public Law 99-141 for the Advanced Science Center, the Center for Science and Technology, the Center for Energy and Biomedical Technology, the Energy and Mineral Research Center, and the Demonstration Center for Information Technologies [as described in the report accompanying this Act; together with not to exceed $6,000,000, to be derived from revenues from activities of the Technical Information Services, which shall be credited to this account and used for necessary expenses and shall remain available until expended], shall be available for other expenses of energy supply, research and development activities. (Public Law 99-141, making appropriations for energy and water development, 1986.)

DEPARTMENT OF ENERGY
FISCAL YEAR 1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF ESTIMATES BY APPROPRIATION BY MAJOR ACTIVITY
ENERGY SUPPLY RESEARCH AND DEVELOPMENT

(Budget Authority in Thousands of Dollars)

	FY 1985 Actual	FY 1986 Estimate	FY 1987 Request
Solar Energy	$ 171,587	$ 144,624	$ 72,292
Geothermal	29,698	26,681	17,930
Hydropower	447	481	---
Electric Energy Systems	19,717	11,548	7,619
Energy Storage Systems	18,642	17,292	8,600
Nuclear Energy R&D	412,612	375,684	330,900
Remedial Action & Waste Technology .	170,365	230,047	294,100
Civilian Waste R&D	25,886	16,064	6,500
Environmental, Safety and Health ...	38,053	46,921	76,098
Biological and Environmental Research	187,746	179,950	196,565
Liquified Gaseous Spill Test Facility	4,299	1,732	1,200
Magnetic Fusion	429,553	365,469	333,000
Basic Energy Sciences	410,800	433,770	441,370
Energy Research Analysis	2,970	2,598	3,550
University Research Instrumentation.	4,950	6,254	5,000
University Research Support	10,098	10,296	10,975
Advisory and Oversight Program Direction	2,900	2,674	2,900
Multi-Program Laboratories Facilities Support	33,200	39,824	60,190
Small Business Innovation Research Program	24,724	---	---
In-House Energy Management	14,821	11,709	16,500
Technical Information and Management	13,442	12,413	10,775
Policy and Management	3,380	3,497	3,887
Subtotal, Energy Supply R&D ...	2,029,890	1,939,528	1,899,951
Less Use of Prior Year Balances and Other Adjustment	-62,400	-243,230	-645,789
Total, Energy Supply R&D............	$1,967,490	$1,696,298	$1,254,162

Environment Safety
and Health

DEPARTMENT OF ENERGY

FISCAL YEAR 1987 CONGRESSIONAL BUDGET REQUEST

ENERGY SUPPLY RESEARCH AND DEVELOPMENT

VOLUME 3

ENVIRONMENT, SAFETY AND HEALTH

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Department of Energy
FY 1987 CONGRESSIONAL BUDGET REQUEST
Environment, Safety and Health

PROGRAM OVERVIEW

On September 18, 1985, Secretary of Energy John S. Herrington announced a series of initiatives to strengthen the environment, safety, and health function within the Department of Energy. These new initiatives are the result of a thorough review of the Department's environment, safety, and health functions which identified some areas that need to be strengthened.

There are three key elements of the Department's long-range plan which will provide the framework for a strong emphasis on environmental and safety matters at the Department of Energy. These elements are, of course, to be undertaken in addition to the base program for Environment, Safety, and Health (EH). The first of the elements will be to consolidate oversight responsibility for the environment, safety, quality assurance, and health function under the direction of an Assistant Secretary for Environment, Safety, and Health. The new ES&H office will be integrally involved in the operations of the Department at all levels, will provide line management with more detailed information about the nature of the safety and environmental problems to be dealt with, and will oversee more directly the corrective action to be taken and the safety and environmental aspects of ongoing operations.

Second, EH will conduct a baseline survey of all DOE facilities to identify existing areas of environmental risk. Results from the survey will be used to prioritize areas of environmental risk and to correct environmental problems in a knowledgeable and orderly manner.

Third, EH will perform technical safety appraisals of DOE's high- and moderate- hazard nuclear facilities, approximately 45 in number. These will be multidisciplinary "on the ground" appraisals to determine compliance with safety requirements, industry lessons learned, and licensed facility requirements, as appropriate. As with the environmental survey, results of these appraisals will be used to implement corrective measures.

Other elements of the Department's strengthened program include a field reporting and computer assisted tracking system, a more aggressive ES&H role in the development and implementation of environmental and safety policy for the Department, including more detailed Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act (RCRA/CERCLA) policy guidance and enhanced liaison with State and Federal agencies.

The Secretary's new initiatives in environment, safety, and health are being implemented in FY 1986 utilizing existing Departmental resources. Our FY 1987 budget request, as more fully discussed below, also reflects these new initiatives.

The goal of the Environment, Safety and Health program as the principal advisor to the Secretary is to maintain an effective system throughout the Department in order to:

- assure conformance of the Department's activities with all applicable environmental laws and regulations and assure that the health and safety of workers and the public are protected
- assure that national environmental protection goals are incorporated into the formulation and implementation of energy programs
- assure that environmental and safety concerns are identified, prioritized and addressed through corrective and remedial actions, and areas of environmental and safety risk are reduced

- develop policy options for the Department on the effects of National environmental policy on U.S. energy industries and energy supply and demand

- provide liaison with other federal agencies, such as EPA, concerning regulatory efforts and specific actions of those agencies that may have an impact on DOE operations.

As its principal basis in law, the Environment, Safety and Health program responds directly to the following statutory requirements:

- DOE Organization Act of 1977 - requires the program to advise the Secretary on the conformance of the Department's activities to environmental and safety laws and principles.

- PL 79-585, Atomic Energy Act of 1946 - authorizes research and development for medical, biological and health purposes and for protection of health and promotion of safety during research and production activities using fissionable and radioactive materials.

- PL 83-703, Atomic Energy Act of 1954 - exempts DOE (AEC) contractors from licensing requirements, requires maintenance of health and safety and preservation and enhancement of a viable environment during research and production.

- PL 91-956, Occupational Safety and Health Act (OSHA) of 1970 - exempts certain DOE contractor-operated workplaces from its requirements, and permits agencies to prescribe and enforce occupational health and safety standards.

- PL 96-510, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment, and the cleanup of inactive hazardous waste disposal sites.

- PL 94-580, Resource Conservation and Recovery Act (RCRA) - sets forth requirements to ensure the safe and environmentally acceptable management of solid wastes.

- PL 91-190, National Environmental Policy Act (NEPA) - requires Federal agencies to consider environmental factors in its decisionmaking process for all actions which may affect the quality of the human environment.

- PL 92-500, Clean Water Act - establishes a comprehensive program for controlling the introduction of pollutants into the Nation's water.

- PL 91-604, Clean Air Act - establishes requirements for controlling the introduction of airborne pollutants into the environment.

- PL 93-523, Safe Drinking Water Act - establishes a national program for the protection of drinking water through National Drinking Water Standards, and a program to prevent underground injections which would endanger drinking water sources.

- PL 89-665, National Historic Preservation Act - requires Federal agencies to take steps to protect historic and cultural resources which may be affected by project activities.

- PL 93-205, Endangered Species Act - establishes a means for the protection of threatened and endangered plant and wildlife species.

- PL 85-624, Fish and Wildlife Coordination Act - assures that fish and wildlife resources receive equal consideration with other values in the planning and development of projects affecting water resources.

- PL 94-469, Toxic Substances Control Act - allows for the gathering of information on all new and existing chemical substances and allows for the control of any of those substances determined to cause unreasonable risk to public health or the environment.

- PL 92-583, Coastal Zone Management Act - provides for a comprehensive and coordinated planning effort for the protection of coastal resources, and requires a determination of consistency with coastal zone management plans.

- PL 93-633, Hazardous Material Transportation Act - establishes the framework for regulatory efforts to ensure safe packaging, handling, and transportation of hazardous materials when transported in commerce.

- Executive Order 11988, Floodplain Management - allows Federal agencies to use floodplains for projects only if there are no practicable alternatives available and only if measures have been taken to protect the floodplain.

- Executive Order 11990, Protection of Wetlands - requires Federal agencies to avoid wetlands where practicable.

- PL 96-294, The Acid Precipitation Act of 1980 - requires Departmental participation and support of the National Acid Precipitation Assessment Program.

It is also a program goal, based upon the language of the Department of Energy Organization Act of 1977, to assure that the energy impacts of current and proposed environmental requirements are compatible with National energy goals and conversely, that Federal energy decisions reflect National environmental goals.

The Environment, Safety and Health Program (EH) consists of six major units: Nuclear Safety, Operational Safety, Quality Assurance, Environmental Audit and Compliance, Environmental Guidance, and Environmental Analysis. Their activities include: the development of policies and standards; oversight, including surveys, audits and appraisals to monitor program and field performance in complying with DOE safety and environmental policies and standards and in achieving effective safety and environmental protection performance; technical assistance as needed to foster compliance; maintenance of the resources to respond to radiological emergencies; the review of NEPA documents; and the analysis of energy/environmental issues pertaining to the energy supply industry arising from environmental legislative and regulatory activities.

The program is essential to the continued effective operations of all programs of the Department of Energy.

Fiscal Year 1985 Accomplishments

- In September 1985, the Secretary announced a restructuring of the Department's environmental, safety and health program including, "oversight responsibility for the environment, safety and health function in the Department will be consolidated and upgraded under the direction of an Assistant Secretary for Environment, Safety and Health. At present oversight responsibility for environment and safety is scattered among the Program Assistant Secretaries. Consolidating this function under a strong Assistant Secretary will establish line responsibility and top management commitment to safety and environment. ES&H will be stronger and better organized; it will have more oversight tools and it will be intergrally involved in the functions of the Department at all levels."

- During 1985 the Departmental ES&H programs were examined and changes implemented to improve the independent overview program. These changes included: greater involvement in the authorization process for DOE nuclear operations, and initiation of technical appraisals of DOE high hazard nuclear operating facilities. Technical appraisals provide for a more direct evaluation of the safety of the operation of such facilities.

- Initiated the planning for the performance of in-depth technical safety appraisals of major DOE operating facilities.

- Completed the planning for greater involvement in the authorization process for DOE nuclear operations, and began by performing technical evaluations of some safety analysis reports and taking concurrence actions on several authorizations.

- Conducted two national level drills that demonstrated the ability of the Department to bring its extensive radiological emergency response resources to a nuclear accident.

- Completed the neutron criticality alarm system for use where gamma background radiation is high or where large structures attenuate gamma radiation from a criticality accident.

- Published three reports describing current measurement practices at DOE facilities with recommendations for improvement (air monitoring, beta, internal dosimetry), and developed protocol for evaluation of effluent monitors at DOE facilities.

- Completed development of calibration procedures for extremity dosimeters and guidelines for calibration of portable survey and installed instruments, and developed and field tested a prototype device for "total dose" measurement from combined neutron and gamma exposure.

- Initiated a program to evaluate the effluent and environmental monitoring programs at DOE facilities for the purpose of identifying and correcting program deficiencies.

- Amended DOE radiation standards for protecting members of the public in the vicinity of DOE nuclear facilities to incorporate current recommendations of national and international standards organizations.

- Validated the use of a modified psychological profile test to be used in the Personnel Assurance Program established by Defense Programs for employees working with nuclear devices and in other sensitive positions.

- Completed six medical appraisals of contractor occupational medical programs.

- Conducted thirty-two seminars and workshops in the Management Oversight and Risk Tree (MORT) system safety program in FY 1985.

- Initiated an effort to improve the Department's reporting of environmental trends and incidents.

- The Department's System Safety Development Center provided 2,500 hours of consultation to professionals in DOE operations seeking advice on system safety methodologies, risk assessment, and performance measurement.

- Published the Status of Quality Assurance Implementation in DOE between July 1983 and December 1984. The initial report had covered the time span beginning with the DOE quality assurance policy being established in August 1981 to July 1983.

- Performed two quality assurance appraisals of operations offices and contractors responsible for reactor and nuclear facilities operations; supported ten operations office audits of their contractor quality assurance programs; visited four field organizations to review and evaluate actions taken to enhance quality performance since the initial OQAS survey; and conducted an in-depth quality assurance appraisal of the Bonneville Power Administration.

- Provided protection to DOE projects from non-compliance delays by completing action on numerous requests from DOE programs for National Environmental Policy Act (NEPA) related support, including: approximately 180 analyses to determine/confirm the level of NEPA documentation requirements, i.e., Environmental Impact Statements (EIS's), Environmental Assessments (EA's), or neither, for DOE actions; and 125 major independent reviews of NEPA EIS's and EA's.

  Examples of major EIS reviews performed included those for: Waste Management Activities for Groundwater Protection at the Savannah River Plant, South Carolina; the Oak Ridge Central Waste Disposal Facility; Bonneville Power Administration's Fall River-Lower Valley Transmission Project; Western Area Power Administration's Blue River-Gore Pass Transmission Project; the Niagara Falls Storage Site Remedial Action Project; and the Salt Lake City Remedial Action Project.

- Developed a pilot regulatory review and coordination system to systematically identify, review, analyze, and prepare a regulatory response on external environmental, safety, and health regulatory activities which have the potential for affecting DOE's projects and programs.

- Coordinated the Department's review of EPA's final high-level waste standards (40 CFR 191), developed DOE positions reflecting the views of multiple affected programs, and served as the advocate for DOE positions with other agencies.

- Continued to participate in Departmental activities and assessments concerning acid rain and other transboundary air pollution issues.

- Participated in regulatory analysis studies and work groups that develop the scientific basis for regulations and legislative proposals; this year emphasizing hazardous and solid waste including "Superfund" and Resource Conservation and Recovery Act (amended 1984) proposals, groundwater impacts, national ambient air quality standard revisions and industrial boiler standards.

- Participated in the update of the environmental projections and policy sections of the fifth National Energy Policy Plan.

- Continued to participate in the interagency Indoor Air Quality Task Group and to provide assessments of indoor air pollution issues concerning DOE for these interagency activities.

FY 1986 Projected Accomplishments:

- Implementing the Environmental Survey by completing all necessary planning and preparatory activities and initiating the environmental baseline survey for the first group of 5 sites. Planning and preparatory activities include: assembling a staff; procuring support services; analyzing available site information; developing an implementation plan and schedule for the survey; developing detailed site survey plans for each site to be surveyed; developing survey procedures; developing sampling procedures; developing risk assessment methodologies and criteria for establishing budget priorities; and developing a database for recording and managing the survey results.

- Refining the ES&H ranking system for budgetary prioritization of the Department's environmental and safety upgrade projects.

- Implementing additional modules on the Safety Performance Measurement System for environmental and safety reporting, radiation exposure data, and standards information, and a personnel and resources directory.

- Conducting in-depth technical safety appraisals of the safety of operations at Category A reactors (20 megawatts thermal or greater), high hazard nuclear facilities, and selected moderate hazard nuclear facilities. These technical safety appraisals will be documented, multidiscipline appraisals. They will help to assure Department-wide consistency and application of particular safety elements of the ES&H program, nuclear industry lessons learned, and licensed facility requirements, as appropriate. The majority of the appraisal activity will take place at the facility site which will be examined and evaluated to determine compliance with EH requirements.

- Reviewing reactor safety analysis reports and nuclear facility safety analysis reports. These are in-depth multidisciplinary reviews to assure that an adequate degree of protection of the environment, health, and safety has been designed into reactors, high hazard nuclear facilities, and selected moderate hazard nuclear facilities.

- Development of the Nuclear Criticality Safety Information System will continue with the system being expanded to a nuclear safety database which will include human factors and other nuclear safety data.

- Conducting surveys of about 20 DOE and civilian nuclear sites to develop baseline radiological data.

- Developing a "good practice" manual for uranium facilities and a training manual for radiation protection, and conducting workshops on internal dosimetry, beta dosimetry, neutron dosimetry, effluent monitoring and radiological calibration.

- Initiating a routine DOE Laboratory Accreditation Program for personnel dosimetry and developing a pilot program to test performance criteria for instrument calibration.

- Developing and implementing mandatory radiological practices for effluent and environmental monitoring at DOE facilities.

- Conducting technical evaluations of aviation operating procedures including eight appraisals of DOE aviation operating contractors.

- Conducting Nuclear Safety Program Appraisals of operations offices/contractors responsible for reactor and nuclear facilities operations; participating in twelve operations office audits of their contractor quality assurance programs; and conducting quality assurance management appraisals of four field organizations and one Headquarter Program Office for the implementation of quality assurance requirements.

- Developing guidelines on concept and content of a DOE Quality Improvement Program and Operation Readiness Reviews, and on the application and implementation of quality assurance principles and requirements to DOE computer program software and research and development programs.

- Providing environmental compliance guidance, assistance, and oversight to DOE programs, projects, and other initiatives subject to environmental requirements.

- Completing action on numerous DOE program requests for support, including approximately 180 analyses to determine/confirm the level of NEPA documentation requirements for DOE actions; and 125 major independent reviews of NEPA Environmental Impact Statements (EIS's) and Environmental Assessments (EA's).

Examples of major EIS reviews include those for: High-Level and Transuranic Waste Management Activities at Hanford; the Decommissioning of the 100 Area Production Reactors at Hanford; Thermal Impact Mitigation Measures at the Savannah River Plant; Remedial Action Project at Durango, Colorado; Bear Creek Clean-up at Oak Ridge; Process Facility Modification at Hanford; Bonneville Power Administration's Intertie Access Policy; and the New Pacific Northwest-Pacific Southwest AC Intertie.

- Implementing DOE's regulatory review and coordination system which was developed to systematically identify, track, analyze, and prepare regulatory responses on external environmental, safety, and health regulatory activities potentially affecting DOE activities and operations. Significant activities are anticipated with respect to the RCRA and CERCLA Acts.

- Revising and reissuing the Environmental Compliance Guide for Project Development which details the DOE NEPA process and outlines environmental requirements, and revising and updating a series of Reference Books on the full range of environmental statutes and regulations applicable to DOE project development activities.

- Continue to participate in Department activities, analyses and research related to global environmental issues such as climate change, deforestation, nuclear winter. Much of this work involves participation in interagency forums.

- Providing medical and psychological technical support for the development of human reliability programs for critical and sensitive DOE operations.

- Developing medical standards for DOE critical and sensitive operations.

- Participate in studies, seminars and work groups that address the current state-of-knowledge in global and international environment and natural resource issues; concentration on activities that relate those issues to energy production/development and the interaction between national systems and social and economic demands.

- Continue to provide Departmental leadership and representation to key interagency environmental policy task forces, work groups and advisory bodies. This year such efforts are likely to focus on global and/or mesoscale climate issues that may result from changes in atmospheric levels of greenhouse gases, the after effects of nuclear war, and ozone layer depletion as a result of continued hydrocarbon production/use.

- Develop a new environmental emissions projection system that is compatible with Date Resources Incorporated/World Oil Model economic and energy output to produce emissions outputs for routine displays at the Federal Administrative Regions level.

- Continue updating of The Technology Environmental Characterizations Handbook (March 1983) leading to a loose-leaf notebook replacement of current reports.

Program Objectives for FY 1987 through FY 1990 are to:

- Ensure that the Department's operating facilities are moving towards compliance with all applicable environmental requirements and reduce areas of existing environmental risk by completing the baseline environmental survey and conducting a continuing program of environmental audits.

- Assist in and make recommendations for corrective measures, including assistance with site specific compliance and with other agencies' regulatory requirements.

- Improve the analytic and technical base of the system for budgetary ranking of the Department's environmental and safety upgrade activities.
- Perform more extensive safety reviews of DOE facilities, including Technical Appraisals of Category A reactors and high hazard nonreactor nuclear facilities.
- Continue the review and concurrence of reactor and nonreactor nuclear facility safety analysis reports covering new facilities or modifications and upgrading of existing facilities.
- Continue to coordinate the exchange and sharing of training resources among operating contractors to improve the cost effectiveness and quality of training.
- Issue revised environmental protection, safety and health protection policy guidance for Departmental operations, including comprehensive direction on hazardous waste (RCRA/CERCLA) requirements.
- Play an aggressive role in developing and coordinating comments on the emerging environmental statutes, rules and policies of other agencies potentially impacting DOE.
- Maintain a viable radiological emergency response capability for DOE facilities, in coordination with the Federal Emergency Management Agency, which will be made available on request to other federal and state authorities.
- Develop improved methods for internal radiation dose assessments, to assure compliance with radiation exposure limits recommended by National (e.g., ANSI N13.30, EPA Occupational Exposure Guidance) and International authorities (e.g., ICRP 26 and 30).
- Provide technical advice to field managers on compliance with hazardous waste management under Order DOE 5480.2, and coordinate Departmental responses to reporting requirements under the 1984 Resource Conservation and Recovery Act amendments and on DOE inactive waste site compliance under Order 5480.14. This includes management of DOE's priority list of inactive waste sites and required activities under the National Contingency Plan.
- Establish and operate a computer-assisted information tracking system for environmental and safety data to monitor compliance and progress in completion of corrective actions, and to assist ES&H in reducing areas of environmental and safety risk.
- Support and assist DOE program and field organizations in their development and implementation of the Quality Improvement Program concept.
- Perform quality assurance appraisals of field organizations' programs.
- Protect DOE activities from delays by providing assistance to the Department's programs and projects in preparing National Environmental Policy Act (NEPA) documents and in securing other environmental approvals, permits, and clearances for new projects; and by independently reviewing NEPA and other supporting environmental documents to assure adequate compliance.
- Coordinate with other Federal agencies to resolve difficult compliance issues and to assure the Department's concerns are addressed in emerging regulatory requirements.
- Continue to participate in Departmental activities and assessments concerning acid rain, other transboundary pollutants, and personal exposures.

- Develop a responsive data base and set of information papers concerning the scope and nature of toxic air pollutants related to energy supply and use.

- Develop methodologies and data required to determine policy implications of ground water legislation.

- Improve assessment capabilities for determining the economic, environmental and health tradeoffs involved in the legislative and regulatory initiatives for hazardous substances.

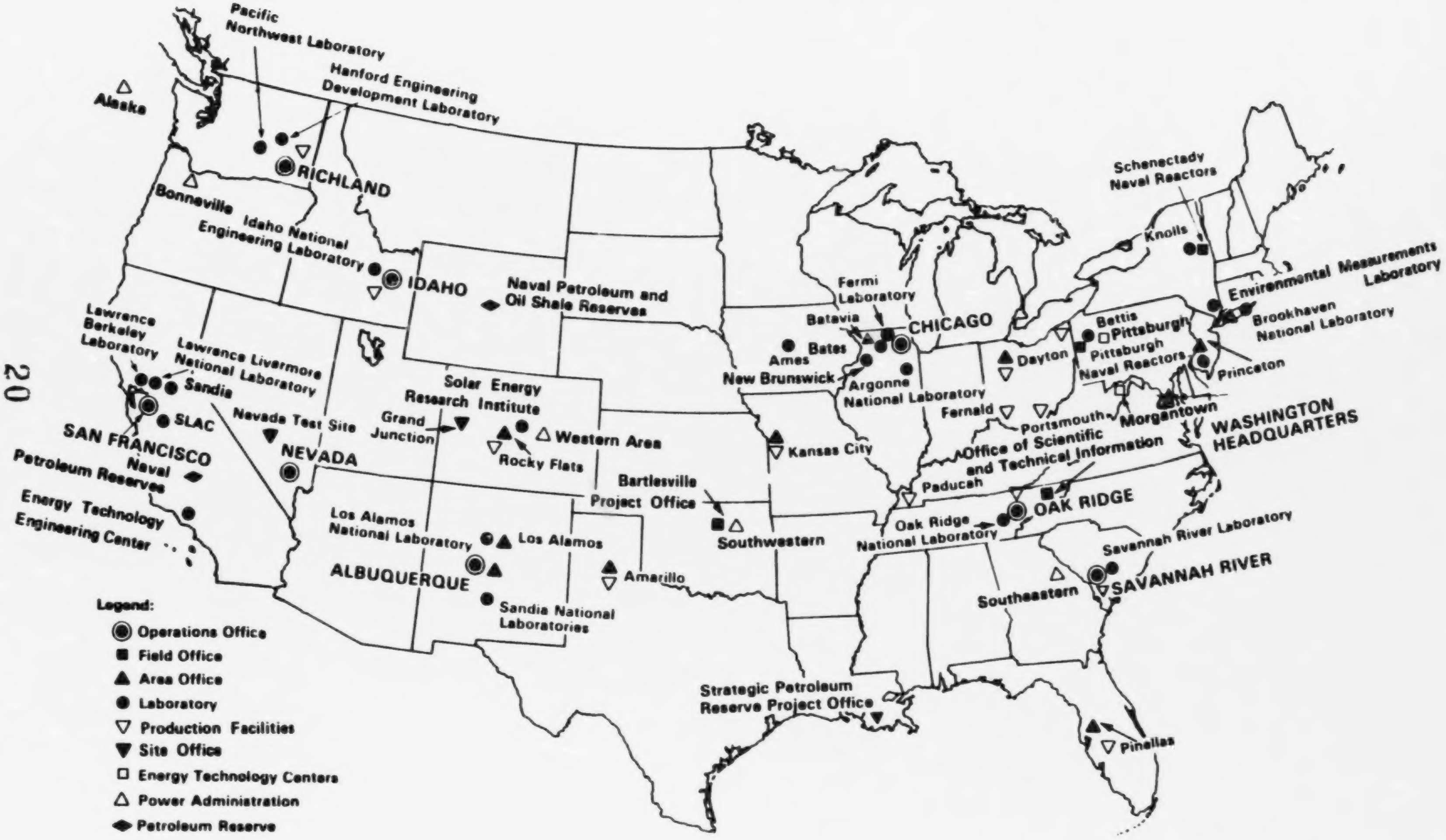
Programmatic Benefits

Accomplishment of these specific objectives will: help assure Departmental compliance with environmental protection, safety and health protection laws and regulations, particularly at nuclear and defense programs installations; enable the Department to establish priorities and develop long-range planning for correcting environmental problems and reducing potential risks; prevent unnecessary DOE program and project delays caused by environmental issues; ensure that a balance is struck between energy and environmental concerns in the formulation of broad national energy policy goals; foster the establishment and maintenance of effective quality assurance procedures and methods in all of the activities of the Department of Energy; and assure adequate protection of the public from current DOE activities, the results of past nuclear operations conducted by the Government, and possible harm associated with radiological emergencies.

The following map shows the diversity of DOE facilities around the United States which must implement environmental protection, safety and health protection requirements. Statistical data on the quality of the field's compliance with these ES&H requirements, in comparison with the compliance experience of industry, is shown in the Operational Safety subprogram section of the budget.

Figure 1: Map of DOE Field Facilities and Operations

DOE FIELD FACILITIES AND OPERATIONS


Pacific Northwest Laboratory
Hanford Engineering Development Laboratory
Alaska
RICHLAND
Bonneville
Idaho National Engineering Laboratory
IDAHO
Naval Petroleum and Oil Shale Reserves
Lawrence Berkeley Laboratory
Lawrence Livermore National Laboratory
Sandia
SLAC
SAN FRANCISCO
Naval Petroleum Reserves
Energy Technology Engineering Center
Nevada Test Site
NEVADA
Grand Junction
Solar Energy Research Institute
Western Area
Rocky Flats
Los Alamos National Laboratory
Los Alamos
ALBUQUERQUE
Sandia National Laboratories
Amarillo
Bartlesville Project Office
Southwestern
Kansas City
Ames
Bates
New Brunswick
Fermi Laboratory
Batavia
CHICAGO
Argonne National Laboratory
Dayton
Fernald
Portsmouth
Paducah
Office of Scientific and Technical Information
Oak Ridge National Laboratory
OAK RIDGE
Southeastern
Savannah River Laboratory
SAVANNAH RIVER
Pinellas
Strategic Petroleum Reserve Project Office
Bettis
Pittsburgh
Pittsburgh Naval Reactors
Morgantown
WASHINGTON HEADQUARTERS
Princeton
Brookhaven National Laboratory
Environmental Measurements Laboratory
Knolls
Schenectady Naval Reactors
Legend:
Operations Office
Field Office
Area Office
Laboratory
Production Facilities
Site Office
Energy Technology Centers
Power Administration
Petroleum Reserve

Department of Energy
FY 1987 CONGRSSIONAL BUDGET REQUEST
LEAD TABLE

Environment, Safety and Health

Energy Supply Research and Development
(Tabular dollars in thousands, Narrative material in whole dollars)

	FY 1985 Appropriation	FY 1986 Adjusted Appropriation	FY 1987 Base	FY 1987 Request	FY 1987 Request vs. Base
Environment, Safety and Health Operating Expenses:					
1. Nuclear Safety	$16,916	$16,916	$16,916	$17,225	+309
2. Quality Assurance	915	914	914	800	-114
3. Operational Safety	5,060	4,373	4,373	3,900	-473
4. Environmental Audit and Compliance	0	7,500	7,500	34,000	+26,500
5. Environmental Guidance	5,540	3,623	3,623	3,900	+277
6. Environmental Analysis	2,392	2,457	2,457	2,700	+243
7. Program Direction	5,730 a/	9,695 d/	10,094	11,473	1,379
(Policy and Management)	(792)	(481)	(505)	(685)	(+180)
Subtotal	$36,553	$45,478 c/	$45,877 c/	$73,998	+28,121
8. Capital Equipment	1,500	1,443	1,443	2,100	+657
Total: Operating Expenses	36,553	45,478	45,877	73,998	+28,121
Capital Equipment	1,500	1,443	1,443	2,100	+657
Environment, Safety and Health	$38,053	$46,921	$47,320	$76,098 e/	+28,778
Staffing Total FTE's b/	100	125	125	127	+2

Authorization: Sec. 103, PL 93-438 and Sec. 203, PL 95-91

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a/ Total estimated funding to support 100 FTE's in FY 85 is $6,000,000.
b/ Excludes 3 FTE's budgeted under the Nuclear Waste Fund in FY 85/86/87.
c/ Includes $7,617,000 for the Secretary's initiative in environment, safety and health, the Environmental Survey, and to help pay salaries and benefits of the additional Federal employees to manage and conduct this new program; funds transferred from other DOE programs.
d/ Includes $810,000 for personnel transferred to the consolidated ES&H office from AS/DP ($-325,000) and A/SNE ($-485,000).
e/ Excludes $700,000 that other DOE programs will issue to LLNL for ARAC support

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Conference	General Reduction	FTE General Reduction	Gramm-Rudman-Hollings Reduction	ES&H Transfer/ Reprogramming	Subtotal	Comparability Adjustments	Adj. Approp. Total
Environment, Safety and Health								
Operating Expenses	$38,864	$ -47	$ -12	$-1,467	$ 7,617	$44,955	$ 523	$45,478
Capital Equipment	1,500	---	---	-57	---	1,443	---	1,443
Subtotal, Environment, Safety and Health	$40,364	$ -47	$ -12	$-1,524	$ 7,617	$46,398	$ 523	$46,921
General Reduction:								
Operating Expenses	-47	47	---	---	---	---	---	---
FTE Reduction	-12	---	12	---	---	---	---	---
Total, Environment, Safety and Health	$40,305	$ ---	$ ---	$-1,524	$ 7,617	$46,398	$ 523	$46,921
Operating Expenses	$38,805	$ ---	$ ---	$-1,467	$ 7,617	$44,955	$ 523	$45,478
Capital Equipment	1,500	---	---	-57	---	1,443	---	1,443

Department of Energy
FY 1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
Environment, Safety and Health
(Dollars in thousands)

FY 1986 Adjusted Appropriation	$46,921
Program increases and decreases:	
o Nuclear Safety	
-- perform extensive safety reviews of DOE operating facilities including technical appraisals of a number of high hazard nuclear facilities	+309
o Environmental Audit and Compliance	
-- Perform Environmental Survey/site sampling at 20 DOE sites; analyze data and prioritize corrective/remedial action required, and support incorporation of funding for corrective actions in the FY 1989 and future years program budgets	+26,500
o Operational Safety, Quality Assurance, and Environmental Guidance and Analysis	
-- Continue FY 1986 activities	-67
o Program Direction	
-- increase contractual support, and travel for the environment, safety and health staff to provide a strong environmental protection and safety capability within the Department. Includes two additional FTE's	+1,778
o Capital Equipment	
-- purchase of computer peripheral equipment to implement a computer assisted information tracking system; replace and upgrade aging equipment at the remote sensing laboratory and its five radiological emergency response aircraft; and purchase air monitoring and other testing equipment for radiation measurement standardization to support the improvement of occupational worker protection	+657
FY 1987 Budget request	$76,098

1. Nuclear Safety - FY 1987 Request $17,225,000

The goal of the nuclear safety program is to assure the safe operation of DOE's nuclear facilities. In pursuit of this the nuclear safety program historically performed an independent safety overview of the Department's nuclear operations, which include 73 nuclear reactors and criticality facilities and approximately over 200 other diverse and highly technical nuclear process facilities, with a replacement value in excess of 70 billion dollars. This independent overview covers the safe operation of all nuclear facilities, protection of workers, the public, and property from adverse affects arising from the operation of DOE nuclear facilities, and associated emergency response resources. It has relied upon policy setting, training, providing technical assistance and guidance to DOE field offices and the performance of appraisals, predominantly of DOE management performance, to assure the proper adherence to sound operating principles. In FY 87 these essential activities will be maintained at a reduced level. Reviews of Safety Analysis Reports on DOE facilities will be conducted.

The Technical Safety Appraisals of DOE's operating facilities, a Secretarial initiative begun in FY 1986, will continue in FY 1987. These multi-disciplinary appraisals of DOE's high and moderate hazard facilities will be completed by the end of calendar year 1988.

To accomplish these augmented objectives the independent nuclear safety program is being upgraded through provision of staff.

The Nuclear Safety program is implemented through two major activities: Nuclear Facility Safety, and Radiological Controls.

	FY 1986 Adjusted Approp.	FY 1987 Base	FY 1987 Request
	($'s in thousands)		
a. Nuclear Facility Safety	$ 5,780	$ 5,780	$ 7,050
b. Radiological Controls	11,136	11,136	10,175
Total Nuclear Safety	$16,916	$16,916	$17,225

1a. Nuclear Facility Safety - FY 1987 Request $7,050,000

Introduction and Background

The Nuclear Facility Safety Activity is a focused effort to:

- o The Technical Safety Appraisals of DOE's high and moderate hazard nuclear facilities, a Secretarial initiative begun in FY 1986, will continue in FY 1987. The objective of these appraisals is to assure the proper application of DOE's safety requirements, nuclear industry lessons-learned, and appropriate licensed facility requirements to DOE's nuclear facilities. They will provide a detailed "hands on" review of all aspects of a nuclear facility's operation, including such areas as reactor safety, process facility safety, criticality safety, health physics, emergency preparedness, quality assurance, operator training, maintenance, industrial hygiene, occupational safety, fire protection, and transportation and packaging safety. In the three-year period starting in FY 1986, approximately 50 of the Department's Category A reactors high hazard nuclear process facilities, and selected moderate hazard nuclear facilities will be appraised in this effort.

- Develop Departmental policy, standards, and requirements to be followed by all line organizations and operations offices to assure adequate safety of nuclear operations. To accomplish this effort an expert Federal staff, strengthened by technical specialists from the laboratories and other contractors, is required. The Federal workforce conducts appraisals, develops policy, participates in reviews of safety documentation, and manages the outlay projects. The outlay program includes activities that will maintain standards and related guidelines, provide for the most effective review and analysis of the Nuclear Regulatory Commission (NRC) and industry licensing requirements and operating experience, maintain nuclear facility operator training support activities, and provide safety technology to upgrade the design and operations of DOE's very diverse nuclear facilities.

- Conduct an independent overview of the quality and effectiveness of the Department's nuclear safety programs, which in FY 87 will include: formal appraisals of line management performance to assure consistent implementation of the Department's nuclear safety policies; in-depth technical appraisals of the safety of major operating nuclear facilities; reviews and analyses of safety analysis reports and of unusual occurrence reports; analyses of facility operational performance; and the review of Nuclear Regulatory Commission regulations and guidance to determine their applicability to the Department's nuclear operations.

- Develop and promulgate general minimum qualification and training guidance for personnel responsible for the management and operation of Department-owned nuclear facilities.

- Implement a coordinated approach to the development of nuclear criticality safety technology and guidance for applying the technology to operation of the Department's reactors and nuclear process facilities.

- Conduct generic safety studies of Departmental facilities and operations which provide a base for the development of policy, standards, and guidance to strengthen Departmental nuclear safety programs.

FY 1987 Request: $7,050,000

The FY 1987 budget request for nuclear facility safety of $7,050,000 is a $1,270,000 increase over the amount budgeted in FY 1986. The activities in support of this budget request are described below.

Development and interpretation of policy, standards and guidance for the safety of operations at nuclear facilities will continue, including analysis of emerging nuclear-related safety and health issues, important to a wide variety of DOE's nuclear operations. This includes a continuation of the nuclear safety technical assistance provided by eminent experts in various fields of nuclear safety technology from industry, universities, and laboratories to support DOE's reviews of safety issues, appraisals of field and contractor operations and other specialized technical needs. Other generic projects include a continuation of DOE-wide support in the design criteria for response to natural phenomena such as earthquakes, winds and floods and a continuation of the general application of probabilistic risk assessment methods to the safety analysis of nuclear facilities.

Improvements in the content of training programs for reactor operations and nuclear facility personnel will be continued. Training program activities will include: (a) development of training program and evaluation criteria for nonreactor nuclear facilities and guidance for structured on-the-job training programs; (b) coordinated exchange, consolidation and sharing of related training materials and methods among reactor and nonreactor nuclear facility operating contractors to improve cost-effectiveness and overall quality of training programs Department-wide; and (c) development of text material and lesson plans to support the Performance Based Reactor Operator Fundamental guides prepared in previous years. In addition, training courses for DOE and contractor staff in criticality safety and lessons learned from various DOE safety experiences will be continued.

Continuing improvements in nuclear criticality safety are needed if the Department is to continue to meet its responsibility for the safety of its workers and protection of its programs. A criticality accident would have a severe impact on DOE's expanding nuclear weapons and related activities and would indirectly impact the licensed industry. Between 1958 and 1962, the Department's operations experienced five criticality accidents with one fatality and some severe radiation exposures to workers. In response to these accidents, criticality safety was improved, and better techniques for criticality control were developed. The natural consequence was a better safety record for a few years. However, a major criticality accident in 1978 shut down a key facility for 2 years even though there were no radiation overexposures. Also, over the years few improvements had been made, reference documents had not been updated to incorporate more accurate data, and a coordinated approach to criticality safety technology was lacking. In order to improve this situation, the Office of Nuclear Safety started a nuclear criticality safety effort in FY 1985 in such areas as (1) physics of criticality, (2) computational capability, (3) communications and information, and (4) knowledge of factors affecting criticality. In FY1987, efforts will continue in the areas of dissemination of criticality safety information, maintennance of calculational capabilities, and improvements of the understanding of physics of criticality. Updating of base technical documents will be continued. Continued maintenance of nuclear criticality safety is important to the Department's defense and nuclear energy missions.

Efforts to evaluate current and evolving nuclear safety criteria and operating experiences at licensed facilities will continue to assure that all actions being taken to enhance the safety of licensed nuclear facilities are considered for their applicability to the Department's reactors. Independent technical experts from universities and industry will continue to be made available to support Nuclear Safety activities, including a continued support to program and field offices in performing specific safety reviews. In FY 1987, minimal programs in the area of human factors applications to the design and safe operation of reactors and nuclear facilities and in the screening for potential application of licensed reactor criteria and experiences to DOE reactors will be maintained. Seminars on safety experiences from past nuclear facility operations will be continued, as will the technical training seminars in selected emerging safety technologies.

Other improvements in nuclear process facility safety will also continue in 1987 as part of the Department's efforts to improve safety of its nuclear operations. For example, development of computer programs to analyze the effects of explosions in ventilation systems will be completed.

In addition to the performance of the above continuing efforts, the Office of Nuclear Safety will intensify the performance of technical appraisals of high and selected moderate hazard nuclear facilities in order to provide a more uniform and direct evaluation of the safety of the operation of such facilities. Utilizing standard performance objectives and criteria that are results oriented, such evaluations will focus on facility operations, maintenance, technical support, training, radiological protection including effluent control and emergency preparedness. These technical appraisals will provide a more direct evaluation of the safety of the operation of such facilities by assuring DOE-wide consistency in the application of DOE requirements, application of nuclear industry lessons-learned, and application of appropriate licensed nuclear facility requirements. Consultants and Federal employees will be used to provide the needed technical expertise in the required disciplines for these technical appraisals.

There will be increased involvement in the nuclear facility operations authorization process through the independent review and concurrence of reactor and nonreactor nuclear facility safety analysis reports for new facilities and facilities undergoing significant modifications. This will be accomplished through a greater number of safety analysis report reviews for new facilities and facilities undergoing significant modifications. These reviews focus on the technical aspects of the safety analysis report and form the basis for concurrence on these risk-related actions. Consultants and Federal employees will be used to provide the needed experts in the required nuclear disciplines for these reviews.

1b. Radiological Controls - FY 1987 Request $10,175,000

Introduction and Background

The Radiological Controls activity provides a balanced effort to:

- Provide management and policy direction to Department-wide radiation protection programs to meet the demands of the 1980's arising from changes in recommendations and regulations and new emerging technologies. Provision is made for technical assistance through direct staff support.

- Maintain state-of-the-art capabilities to provide for occupational radiation worker protection through advances in measurement and calibration technology, operational health physics design and assessment and accreditation.

- Conduct independent overview and appraisals using the Federal workforce to achieve consistent and validated radiation protection and emergency preparedness at all Department-controlled facilities.

- Provide technical emergency preparedness assistance, including planning and accident response capability to field offices in responding to radiological problems and emergencies.

- Provide leadership, as requested, on interagency, national and international standards committees dealing with radiation guidance. Radiation protection codes, guides, standards and procedures are developed for use by DOE field operations. The policy is formulated by the Federal workforce using data and information obtained from supporting outlay projects. Through the appraisal program, the effectiveness of their field-level implementation is assessed and, as appropriate, included in modifications or formulations of DOE radiation protection policies. At the same time, close interaction is maintained with national and international radiation standards development bodies both to provide these groups with the wide spectrum of DOE experience in occupational radiation protection and to monitor technological and operational developments for possible application to the Department.

Emergency response activities provide resources to monitor and assess any accidental release of radioactivity from a nuclear facility. Aircraft are maintained to be ready to employ state-of-the-art remote sensing equipment to rapidly map large areas which may have been affected by an accidental release. A computer-based system, called the Atmospheric Release Advisory Capability (ARAC), provides a radiation exposure prediction capability in the event of an accidental release. This system uses actual weather and terrain to predict on a regional scale the transport, diffusion, and deposition of any radioactivity released to the environment. Complementing these resources is an experienced cadre of scientists, engineers and technicians who are always available to assist local authorities and to coordinate DOE, DOD, and other Federal responses to an accident.

FY 1987 Request: $10,175,000

The FY 1987 budget request for Radiological Controls is $10,175,000, a $961,000 decrease below the amount budgeted in FY 1986. The activities are discussed below.

Enhanced measurement sensitivity for measuring the levels of radiation that workers are exposed to is necessary to implement anticipated changes in the basic Federal radiation protection guidance by EPA, increased dose estimations for neutrons and x-rays arising from changes in quality values, and preparation for technological changes in DOE nuclear materials production.

Continuing efforts will be specifically directed to improvements in external and internal dose assessment, including characterization of radiation fields at DOE facilities, calibration and accreditation. In response to changes in radiation protection arising from the new EPA occupational exposure guidance, guidance for summing internal and external exposures will be developed. Efforts will be initiated to correlate measurements to actual risk in order to strengthen the DOE position regarding litigation and to analyze long term impact of DOE exposure control and ALARA policy.

Concurrent with substantial improvements in measurement capabilities and technology, improvements to radiation record systems will also be developed and implemented. While improvements to the quality of the records will be a goal, uniformity of records between sites will also be a prime objective.

The Department's emergency response capability will be maintained in a state-of-readiness by means of both the Aerial Measurements System (AMS) and ARAC. Radiometric surveys of major nuclear installations in the U.S. will continue in order to provide the essential baseline for determining the consequences of any radiological accident. The ARAC will continue its readiness to provide computer-generated predictions of dispersal of radioactive material during an emergency, and will participate in emergency exercises and drills. Plans will continue (begun in FY 1985) to mesh the ARAC system together with NRC's assessment system, for use during an emergency at a licensed nuclear power plant. One simulated demonstration of the emergency response capability is planned. This will utilize the radiological assistance capability of a field office that will be the host. This would demonstrate the Department's ability to manage a major radiological accident on a regional basis. The radiological assistance capability will be maintained. This activity represents a regional response capability, providing monitoring and equipment as required in the case of a radiological accident.

Federal Personnel - Office of Nuclear Safety

	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request
Total FTE	37	37	37

Federal Personnel

The Department's Action Plan on nuclear safety after the TMI accident called for a reassessment of staffing levels needed to adequately discharge the Department's nuclear safety responsibilities associated with its nuclear operations, and for internal adjustments as indicated by that assessment. A formal, comprehensive study was made in FY 1982, and updated in 1984, to determine the nuclear safety manpower required for all Departmental elements. For the activities assigned to the Office of Nuclear Safety, a significant increase in FTEs was found to be needed. Since the Department's nuclear safety programs continue to expand, the staffing requirements determined by the study are considered to be an important benchmark. Maximum use is made of contractor technical support.

A trained and experienced staff is essential to fulfilling the mandate and responsibilities of the Office. The safety and health specialties that are represented in the staff are nuclear physics and engineering, nuclear operations, nuclear criticality, nuclear process control, radiological protection, and emergency response planning and testing. In addition to developing Departmental policy, standards and requirements, and interpreting these policies, the staff appraises the adequacy of the implementation of these policies and requirements by DOE's line organizations, provides expert technical advice and analyses to all DOE organizational elements, and performs technical evaluations of the adequacy of current and planned DOE operations to: protect the safety and health of workers and the public; protect the environment; and protect Government property from accidental loss or damage. The staff also manages the contracts which supports these activities.

To more directly evaluate safety of operating facilities Office of Nuclear Safety staff will conduct technical appraisals of DOE high hazard nuclear facilities, concur in safety approval actions on reactors and high hazard nuclear facilities, and conduct HQ independent review of reactor and nonreactor nuclear facility safety analysis reports. Technical appraisals will provide a more direct evaluation of the safety of the operation of such facilities by assuring DOE-wide consistency in the application of DOE requirements, application of nuclear industry lessons-learned, and application of appropriate licensed nuclear facility requirements. Independent review of facility safety analysis reports will determine whether the risks presented by the facility operation are accurately represented and whether the risk is reasonable.

Involvement in the nuclear facility operations authorization process will be significantly increased through a greater number of safety analysis report reviews for new facilities and facilities undergoing significant modifications. These reviews focus on the technical aspects of the safety analysis report and form the basis for EH concurrence on these risk approval actions. Current projections indicate that EH will be required to take concurrence actions on approximately sixteen approval requests per year.

Maximum use of contract support will be made in the performance of technical appraisals and the review of Safety Analysis Reports.

2. Quality Assurance - FY 1987 Request $800,000

Introduction and Background

The Quality Assurance Program assures that the Departmental policies and activities governing quality assurance are adequate to meet the needs of the missions and objectives of the Department. This Program develops Departmental quality assurance policies and standards and conducts independent overview, appraisals, and support activities to assure and to assist in their implementation.

Quality assurance is a system of management controls and procedures applied to programs to assure that output - whether product, data, processes or services - conforms to requirements established by management. Quality assurance has been applied systematically in the aerospace and nuclear industries for years as a means to assure safety and reliability of systems. More recently, management programs to improve quality are being pursued to achieve other important dividends including dollar savings, customer satisfaction, and higher productivity. In the DOE, the quality assurance policy is intended to assure that its programs achieve a high degree of operational success with due consideration to performance, reliability, health, safety and environmental protection concerns.

FY 1987 Request: $800,000

The FY 1987 budget request for Quality Assurance (QA) is $800,000, a $114,000 decrease below the amount budgeted for FY 1986. The request includes funds for contractor services to support 1) independent quality assurance appraisals of DOE activities, 2) the maintenance of the unusual occurrence reporting system (somewhat analagous to the NRC's Licensee Event Reports), and 3) the Department's standards program.

As part of the overall plan to strengthen the Department's safety and environmental activity, the Department has centralized the Headquarters quality assurance function to provide a strong institutional organization that will serve as a focal point for quality assurance policy development, leadership, technical support, and verification of quality objectives. A primary responsibility assigned to QA is to conduct independent quality assurance overview and management appraisals of DOE programs. The appraisal activity includes: management appraisals of the quality assurance programs of the line-management offices, technical appraisals of selected nuclear facilities, and appraisals of contractor facilities and operations. Contract support is utilized to supplement available Federal staff expertise in specialized areas where it would be inefficient to maintain a particular expertise on a regular basis.

Federal Personnel - Office of Quality Assurance

	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request
Total FTE	8	8	8

The activity of QA comprises eight staff-years of Federal effort. About six person-years of effort are provided through procurement of contractor services. This distribution of resources applied to the activities of QA is based on several operational considerations such as policy development and overview, appraisals, and the necessary direct communications and technical assistance within the DOE quality assurance community.

3. Operational Safety Program FY 1987 Request $3,900,000

The Operational Safety Program has Departmental responsibility for providing oversight of all DOE Government-owned, Contractor-operated facilities to assure that DOE contractor employees at these facilities are protected against occupational hazards and are provided with a safety and healthful workplace; that the public, public property, and DOE property are protected against the hazards that may result from the operation of these facilities; and that applicable Federal, State and local laws and requirements are complied with. The Program also assures that DOE safety and health responsibilities in areas specifically exempt from other Federal legislation, such as the Occupational Safety and Health Act and Federal Aviation Administration requirements, receive Department-level oversight. The scope of the program includes occupational medicine, industrial hygiene, occupational safety, explosives safety, systems safety, hazardous materials packaging and transportation safety, non-nuclear facilities safety, aviation safety, fire protection, safety analysis and review system, and the safety and health performance measurements system. The Program is responsible for developing safety and health policies and requirements, conducting evaluations and appraisals, and providing technical advice, support, and assistance to Headquarters and field organizations, to assure adherence to those policies and requirements.

The program is comprised of two major activities:

- o Safety and Health Performance Measurement
- o Safety and Health Protection

	FY 1986 Adjusted Appropriation	FY 1987 Base	FY 1987 Request
	($'s in thousands)		
a. S&H Performance Measurement	$ 1,685	$ 1,685	$ 1,550
b. Safety & Health Protection	2,688	2,688	2,350
Total Operational Safety	$ 4,373	$ 4,373	$ 3,900

3a. S&H Performance Measurement FY 1987 Request $1,550,000

Introduction and Background

The objective of this activity is to collect, analyze, and disseminate information related to S&H performance at Field organizations and within the DOE program offices for use by Field organization and Headquarters management and the public. This information provides feedback on the adequacy of the S&H programs and is used for resource allocation and risk assessment and to develop and teach advanced system safety techniques and methodologies for field application, with the ultimate goal to reduce S&H risks in DOE operations.

1987 Request: $1,550,000

The FY 1987 budget request for S&H Performance Measurements is $1,550,000, which is a $135,000 decrease below that budgetet for FY 1986. The requested level of funding will permit operation of all seven modules of the DOE S&H Performance Measurement System, providing the Department with the capability to make selected comprehensive analyses of its safety, and health program.

The requested level of funding also will permit a continued strong program of workshops and seminars to provide approximately 3,000 student-days of instruction in advanced system safety methodologies.

3b. Safety and Health Protection FY 1987 Request $2,350,000

Introduction And Background

The objective of this activity is to assure the safety and health of the public, to protect Government properties against accidental loss and damage, and to assure safe and healthful work places and conditions of employment for both DOE and contractor employees at approximately 225 industrial and research sites involving both nuclear and non-nuclear operations with a replacement cost of over $90 billion across the United States. Emphasis is on aviation safety, transportation packaging safety, fire protection, explosives safety, Safety Analysis and Review System, industrial safety, occupational medicine, and industrial hygiene. Through this activity, the Safety and Health policies, standards, and requirements are developed for the Department, independent appraisals of the program offices and field operations are conducted, and technical guidance and interpretation of policies and DOE Orders are provided. Results of appraisals are provided to DOE senior management as an integral part of the ES&H assurance system. Through this activity the Department is provided an effective occupational safety and health program that is consistently better than that of comparable private sector organizations.

The new direction of safeguards and security activities in the Department requires increased support and assistance in the development of safe, effective security force operations. The security aircraft operations have generated a 25,000 labor-hour per year increase in risk to employees engaged in the more hazardous security aircraft operation. Aviation safety efforts are focused on the operation of about 45 DOE-owned aircraft for daily use, and the charter of an additional 15 to 20 aircraft on a frequent basis.

FY 1987 Request: $2,350,000

The FY 1987 budget request for Safety and Health Protection is $2,350,000, a $338,000 decrease below the amount budgeted in FY 1986. The requested funds will enable the basic functions to continue, with emphasis in the following areas:

- Develop a standard human reliability program for all DOE contractor medical departments, instead of the independent and diverse development now underway.

- Complete medical standards for all sensitive positions, and rewriting of all Orders pertaining to contractor Occupational Medical departments.

- Continue the Toxic Material Advisory Program to provide toxicity data and exposure guidelines upon request. The industrial hygiene task force activities will emphasize implementation of new engineering methods for controlling occupational exposure to toxic chemicals; and the respirator studies program will continue to test special DOE developed equipment and provide guidance to all DOE contractors on all aspects of respirator use.

- Continue fire protection surveys at the Strategic Petroleum Reserve, Lawrence Livermore National Laboratory, and Gaseous Diffusion plants.

- Continue the high explosive safety training program; continue the Explosive Safety Information Data System; and develop guidance procedures for assessing risk in explosives operations.

- Continue efforts on fire risks in control rooms and the influence of fire on ventilation systems, and initiate new study on efficacy of loaded HEPA filters under fire attack.

- Conduct six appraisals of aviation safety operating contractors and hold a workshop for field organization safety personnel with aviation overview representatives, continue to evaluate procedural operating documents for field offices.

- Continue the Safety Analysis Review System (SARS) program, provide technical assistance to field and program elements and conduct SARS program appraisals.

Federal Personnel - Office of Operational Safety

	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request
Operational Safety FTE's	22	22	22

The principal objective of Operational Safety is to assure a continuing high level of performance of S&H activities at DOE facilities. The following essential disciplines are represented by the Operational Safety staff: occupational medicine, industrial hygiene, explosives safety, safety data analysis, fire protection, aviation safety, and occupational safety. In addition to developing S&H policy, standards, and requirements, interpreting these policies for field operations, and overviewing the implementation of these policies, the staff manages technical projects in support of these activities.

The ability of the Operational Safety program to maintain and improve upon the high level of performance for safety and health protection throughout DOE depends primarily on the availability of skilled technical staff at DOE Headquarters to work with DOE field and program offices. To continue to provide effective services to the Department in assuring and continuing a high level of performance in S&H activities and to enhance the safety overview and assurance of all operations, a competent and adequate federal technical staff is required.

4. Environmental Audit and Compliance - FY 1987 Request $34,000,000

Introduction and Background

The Environmental Audit and Compliance Program was initiated in FY 1986 as a principal element of the Secretary's plan to strengthen the Department's Environment, Safety and Health Programs. The goal of the Program is to ensure that the Department's operating facilities are in compliance with all applicable environmental requirements and to reduce areas of existing environmental risk. This is accomplished through a number of activities which include: a one-time baseline Environmental Survey of all DOE operating facilities followed by a continuing program of regular environmental audits of all operating facilities; a continuing process of evaluating compliance needs and establishing budget priorities DOE-wide; evaluations and recommendations concerning the selection of corrective measures; and continuous tracking and monitoring of compliance progress from initial identification of needed corrective measures through completion and operation of such measures. In addition, the Program provides technical assistance and support to program and field offices in the design and implementation of corrective measures. The Program also serves as liaison with federal and state agencies in the resolution of compliance issues concerning operating facilities, including site-specific problems related to corrective measures.

FY 1987 Request $34,000,000

The FY 1987 budget request for the Environmental Audit and Compliance Program is $34,000,000, which is $26,500,000 above the FY 1986 level. The principal activities of the Environmental Audit and Compliance Program in FY 1987 will be the continuation of the Environmental Survey and ongoing support and oversight functions.

The purpose of the one-time baseline Environmental Survey, which was initiated in FY 1986 and which is expected to be completed in late FY 1988 or early FY 1989, is to identify and prioritize areas of existing environmental concern and risk DOE-wide. The results of the Survey will enable the Department to develop, on a uniform basis, comprehensive, long-range planning for correcting environmental problems and reducing environmental risks. During FY 1987, the baseline survey for approximately 20 DOE sites will be completed.

The Survey Program covers all media, i.e., air, water, and soil, and all areas of environmental regulation, e.g., the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation, and Liability Act. The Survey Program also covers all DOE programs and major operating facilities and involves a baseline survey of approximately 40 DOE sites at which there are an estimated 600 inactive waste areas, 300 hazardous waste management areas, 1800 air emission stacks, and 400 wastewater outfall pipes.

The environmental baseline survey of a site is conducted by a multi-disciplinary team of specialists headed by DOE ES&H personnel. There are 5 survey teams with 7 to 10 members on each core team. The core teams are supplemented, for sites with a large number of inactive waste disposal areas by additional 2 or 3-member components specialized in the assessment of such areas. The team leader and assistant leader for each team are Federal ES&H employees, who are supported by technical experts from the National Laboratories and contractors.

A major cost component of the baseline survey is preliminary sampling and analysis sufficient to determine the existence and seriousness of environmental problems at DOE sites. Most of the preliminary sampling and analysis activity is directed at the Department's inactive waste disposal areas.

The results of the baseline survey, including sampling and analysis, are evaluated for purposes of identifying environmental compliance needs, assessing risk, establishing annual budget priorities, and developing a long-range plan for correcting problems and reducing environmental risks on a DOE-wide basis. After completion of the Environmental Survey, the program will conduct regular environmental audits which will cover all DOE facilities on an ongoing basis to monitor the progress of necessary corrective actions, to ensure compliance with environmental laws and regulations, and to evaluate field office practices and procedures.

During FY 1987, the Environmental Audit and Compliance Program will also perform a range of continuing support and oversight functions, including: technical support and assistance in resolving problems associated with environmental permitting; technical reviews of environmental control and remedial action projects; coordination of the resolution of Department-wide environmental compliance issues; and preparation of statutorily mandated Departmental reports such as the Federal Facilities Inventory Report required under Section 3016 of RCRA.

Federal Personnel - Environmental Audit and Compliance

	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request
Total FTE's	18	18	20

The responsibilities of the Office of Environmental Audit and Compliance, including the Environmental Survey, the continuing program of environmental audits, field liaison for compliance, and support and oversight functions, involve policy interpretations and other activities that can only be performed by agency staff. The staffing level requested would provide the minimum number of agency staff required to fulfill these responsibilities.

In addition to conducting the Survey and, subsequently, the environmental audits, the staff manages the contracts that support these activities, and performs a number of support and oversight functions including:

- Providing technical assistance and support to Departmental program and field offices in designing and implementing corrective actions;
- Participating on an ongoing basis in the prioritization of areas requiring corrective actions and projects to implement such corrective actions;
- Evaluating the adequacy and cost-effectiveness of alternative corrective actions;
- Making recommendations concerning the selection of corrective actions;
- Providing support to the field on environmental issues, such as permitting for waste management;
- Reviewing environmental permits and resolving environmental compliance issues;
- Providing liaison for field offices in their dealings with other Federal and state agencies on environmental compliance issues;
- Preparing statutorily mandated reports, e.g., Inventory of Federal Facilities under Section 3016 of RCRA, and the A-106 Pollution Abatement Report;
- Providing recommendations to the Office of Environmental Guidance in the development of guidance, standards, and directives on environmental matters; and
- In coordination with the Office of Environmental Guidance, providing environmental training opportunities to keep DOE personnel informed on environmental compliance requirements.

5. Environmental Guidance - FY 1987 Request $3,900,000

Introduction and Background

The Environmental Guidance Program was strengthened in FY 1986 as part of the Secretary's plan to improve the environment, safety, and health functions within the Department of Energy. The program represents the integration and enhancement of functions previously performed by the former environmental compliance and environmental protection elements.

The overall mission of the program is to assure DOE-wide understanding and implementation of environmental laws and regulations applicable to DOE projects and operations. The mission is fulfilled through the development of compliance policies and generic guidance documents, standards, and internal DOE orders, which cover the full range of environmental statutes and regulations. The Office also keeps DOE personnel abreast of emerging and changing environmental requirements and serves as the advocate for DOE's position with respect to other agencies' rulemaking efforts. In addition, the Office maintains its NEPA assurance functions, including independent NEPA review activities.

Consistent with the Secretarial decision to strengthen the environmental, safety, and health functions, the program will play a more active role in the development and coordination of Department comments on emerging environmental statutes, rules, and other Federal agency policies that could impact DOE. To accomplish this element of the program mission, EH will utilize the Department's regualtion review and coordination system. The system was designed to keep DOE personnel abreast of emerging and changing environmental regulations which may have an impact on the Department's activities, and is used to identify regulations which could have serious implications for the Department, monitor the progress of rulemakings to assure that those regulations affecting the Department are not overlooked, and to provide a mechanism for the Department to prepare a unified regulatory reponse to other Federal agencies which would protect the Department's interests from unduly restrictive and costly environmental requirements.

The environmental guidance element will provide greater and more detailed policy guidance to DOE field offices with respect ot the implementation of the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended.

Compliance with environmental requirements protects the environment and public health and is a prerequisite to the implementation of Departmental programs and projects. In addition to increased risks of harm to the public and environment, non-compliance or late compliance can result in needless, prolonged, and costly delays as a result of litigation or other reasons. Therefore, another important element of the mission is to protect DOE programs and projects from delays in implementation due to non-compliance with the National Environmental Policy Act (NEPA) and other environmental requirements that are necessary prior to project implementation. This NEPA assurance function is fulfilled through generic guidance as well as project specific assistance and independent review activities.

Examples of major environmental requirements applicable to the Department are provided below.

Major Environmental Requirements
Applicable to the Department of Energy

o The National Environmental Policy Act

o The Resource Conservation and Recovery Act

o The Clean Water Act

o The Endangered Species Act

o The Fish and Wildlife Coordination Act

o Hazardous Materials Transportation Act

o Safe Drinking Water Act

o Toxic Substances Control Act

o The National Historic Preservation Act

o The Comprehensive Environmental Response, Compensation, and Liability Act

o The Coastal Zone Management Act

o The Clean Air Act

o Executive Order 11988, Floodplain Management

o Executive Order 11990, Protection of Wetlands

FY 1987 Request: $3,900,000

The FY 1987 budget request for the Environmental Guidance program is a $277,000 increase over the amount budgeted in FY 1986. This request will enable the environmental guidance element to implement an environmental guidance program consistent with the Secretarial decision to strengthen the Department's environment, safety, and health functions.

The Guidance element will implement the Department's regulation review and coordination system to facilitate early identification of emerging environmental statutes, environmental regulations, and external environmental policies which may have effects on Departmental activities, and to pursue a framework under these activities which would be compatible with DOE actions. Efforts will be directed towards those regulations having the most potential impact on DOE facilities. Such items expected to be reviewed under the system in FY 1987 include: the Safe Drinking Water Act and the National Primary Drinking Water Standards; EPA Low-level radioactive waste standards; major RCRA regulations, procedures, and guidance; CERCLA regulations, procedures, and guidance; and standards for protection against radiation.

The Guidance element will also implement a program for assuring DOE-wide understanding and implementation of environmental requirements. The program will review internal environmental orders and standards to determine any need for revision, and revise those internal orders and standards as appropriate to be consistent with the new and enhanced organizational responsibilities of ES&H. Orders anticipated to be reviewed include the DOE order on RCRA, CERCLA, radiation protection standards, and environmental protection standards. The program will develop and provide to DOE program and Field offices comprehensive and detailed guidance on implementing recent initiatives in hazardous waste areas, such as the 1984 RCRA amendments and associated emerging regulations. In addition, the program will also develop policy and procedures to implement new DOE environmental programs. In addition, the Guidance element will provide for environmental training opportunities to inform and educate DOE personnel on environmental requirements and policies.

The program will also continue its NEPA activities on behalf of the Department. Based on identified projects and other initiatives, the FY 1987 workload is expected to include approximately 180-200 analyses of Department actions to determine/confirm the level of required NEPA documentation and to provide other early advice, and an estimated 140-160 independent reviews of NEPA and other environmental documentation to assure that standards of document adequacy are met.

The technical analyses performed by the guidance element in support of NEPA reviews, standards setting, and the development of DOE environmental policy positions on emerging regulations often entail complex scientific matters such as risk assessment, predictions of exposure levels due to airborne radionuclides, groundwater transport of radionuclides, and groundwater migration of hazardous waste. The contract funding requested will provide for specialized technical support for the Federal staff to ensure the scientific and analytical accuracy and objectivity of the Department's positions. Such technical support requires a breadth and depth of specialized skills in combinations which are otherwise not available to staff. The level of funding requested is commensurate with: the expected level of new project activity; the technical complexity of the environmental issues associated with these projects and the technical analyses required in developing regulatory responses to other agency rulemakings, having the most impact on DOE operations.

Federal Personnel - Office of Environmental Guidance

	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request
Total FTE's*	18	18	18

* Excludes 3 FTE's budgeted under the Nuclear Waste Fund.

The responsibilities of the Office of Environmental Guidance, which include the development of internal environmental orders, policies and standards, serving as the DOE advocate for policy positions on the rulemaking activities of other Federal agencies affecting DOE, providing environmental policy guidance and support for DOE facilities, the performance of NEPA oversight functions, and the analysis of environmental requirements and the development of DOE positions. Examples of the types of activities performed include:

- Preparing Departmental comments on emerging environmental statutes, regulations, and other agencies' policies that could impact DOE projects and operations;
- Developing written policies, standards, guidance, and Orders for assuring DOE-wide understanding and implementation of all applicable environmental laws and regulations;
- Providing comprehensive guidance with respect to the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act, as amended.
- Analyzing proposed programs and projects and determining the required level of NEPA review, e.g., environmental assessment (EA), and environmental impact statement (EIS), early in the planning stage of a Departmental action to enable timely preparation of documents;
- Guiding and assisting Departmental offices in scoping the content of and preparing required EA's and EIS's to assure that the full range of environmental issues are adequately covered;
- Independently reviewing all Departmental EA's and EIS's and related environmental documents to assure that NEPA requirements are met;
- Providing guidance to DOE program and field offices on the requirements of NEPA and other environmental laws and regulations relevant to the NEPA process.

The development of these interpretations, policy positions, and other related activities can only be performed by agency staff. In addition, the staff manages the contracts which support these activities. A trained and experienced staff is therefore essential to fulfilling the responsibilities of the element and the level requested would provide the minimum number of agency staff required to fulfill those responsibilities.

6. Environmental Analysis - FY 1987 Request $2,700,000

Introduction and Background

The Environmental Analysis Program provides responsive analyses and options development with respect to significant environmental issues that affect national energy supply, demand and prices.

This mission is accomplished by the analysis and coordination of energy-related environmental issues to assure the full development and assessment of policy options in DOE decisions affecting U.S. energy systems and in the development of associated policies and programs.

A broad range of coordination and support activities are carried out by the office within and outside the Department. The Office maintains cognizance of the activities of other Federal agencies; the Members of Congress, Congressional committees and key Congressional staff; international groups that perform environmental studies and policy development, and private interests.

FY 1987 Request: $2,700,000

The FY 1987 budget request for Environmental Analysis is $2,700,000, a $243,000 increase above the level in the 1986 Congressional Budget Request. Analysis of the impact of proposed environmental regulations and laws on energy policies and the energy industry and continued base level support and participation in acid rain analyses will receive first priority. In this regard, many new environmental regulations (e.g., pursuant to Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, Surface Mining Control and Reclamation Act, etc.) are being proposed or promulgated during FY 1987 which could have significant impact on the nation's energy supply operations. These include the ozone national ambient standard, the electric utility boiler new source performance standard, new standards for energy waste disposal, increased surface mining regulatory activity, a diverse set of nitrogen oxide emission reduction initiatives and hydrocarbon controls for vehicles. Staff have participated actively in the regulatory development process for several years and they have extensive knowledge of the scope and impact of new regulations and national energy systems. This program will continue to provide advice on efficient implementation strategies for national energy systems.

Information management programs will focus on data base maintenance for high-priority air, solid waste, and water quality parameters related to current and forthcoming regulatory actions. A second major assesment report on acid rain will be completed. An environmental analysis of the sixth National Energy Policy Plan will be done. Technical leadership for international environmental issue such as global climate change and trans-boundary pollution will be maintained.

Federal Personnel - Office of Environmental Analysis

FY 1986 Appropriation	FY 1987 Base	FY 1987 Request
8	8	8

Federal personnel requested for the operation of this program serve as the analytical staff to EH on issues relating to energy/environmental policy, environmental regulatory impacts on the energy supply industry, acid rain issues, and other related areas. The current staff level provides an informed, rapid response to major program and policy issues as they develop and insures adequate staffing of interagency and international work groups and task forces on a wide range of topics, including acid rain and transboundary pollution. The staff uses contractors to assist in providing the analyses of energy/environmental issues required to develop a Departmental position and/or to evaluate multiple cost, benefit, and effectiveness criteria related to the impacts of new program direction and regulatory proposals.

7. Program Direction FY 1987 Request $11,473,000

	FY 1986 Adjusted Appropriation	FY 1987 Base	FY 1987 Request
	($'s in thousands)		
Funding; ES&H..............	$9,695	$10,094	$11,473
(Policy and Management)....	(481)	(505)	(685)
Staffing			
Total FTE's a/	125	125	127

a/ Excludes 3 FTE's budgeted under the Nuclear Waste Fund.

FY 1987 Request: $11,473,000

The FY 1987 budget request is $11,473,000 which is an increase of $1,379,000 above the amount budgeted for FY 1986. This request also provides executive direction, management assistance, and administrative support to all programs of the Office of Assistant Secretary for Environment, Safety, and Health. The resources in this request support the Assistant Secretary and budget and administration functions including maintenance of the computer assisted tracking system containing environmental and safety information and data on all DOE facilities.

As part of the Secretary's plan to strengthen the environment, safety and health program within the Department, the development of a DOE-wide Field Reporting and Computer Assisted Tracking System was initiated in FY 1986. The system, which will be completed and implemented in FY 1987, is an essential management tool for the Environmental Audit and Compliance Program, the Nuclear Safety Program, and the Operational Safety Program.

The system will contain comprehensive environmental and safety information for major DOE sites including: the baseline information and recommendations for corrective action developed by the Environmental Survey and the Technical Appraisals, which are also elements of the Secretary's plan; regular appraisal and audit information; field office environmental and safety incident reporting; regulatory agency permit requirements and actions; and, statutory and regulatory deadlines or compliance schedules.

The system will be used to manage and access this very large volume of information for purposes of: determining and monitoring the environmental and safety compliance status of DOE's operating facilities; establishing priorities among compliance needs DOE-wide; developing a long-range plan for correcting problems; monitoring progress in implementing corrective measures; and, fulfilling Congressionally mandated reporting requirements.

Summary of Personnel Compensation

	FY 1986 Adjusted Appropriation	FY 1987 Base	FY 1987 Request
	($'s in thousands)		
Full-time permanent salaries	$6,750	$7,100	$ 7,550
Personnel benefits	788	837	900
Other services	250	250	300
Contractual services	1,057	1,057	1,723
Travel & transportation of persons	850	850	1,000
Total	$9,695	$10,094	$11,473

The budget request for 127 staff years provides a minimum staff to accomplish the Federal staff responsibilities in assuring protection of the environment, safety of the workers and the public, and protection of the property of DOE. This level of staff will be able to provide for extensive, in-depth reviews of DOE facilities and direct assurance of conformance to environmental protection and safety standards. To conduct the Environment, Safety and Health Program, Federal staff are required to provide effective services to the Department in assuring and continuing a high level of performance in ES&H activities. Adequate Federal Headquarters personnel, trained and experienced in ES&H affairs is the most essential ingredient for this program. It is the policy of the Department that policy development and oversight functions be performed only by Federal employees.

The request includes an increase of 2 FTE's, above the FY 1986 adjustment appropriation. The increase in the FY 1987 request is for contractual support for the new Secretarial initiatives, including increased travel and personnel costs.

Summary of Federal Manpower
(In FTE's)

	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request
Nuclear Safety	37	37	37
Quality Assurance	8	8	8
Operational Safety	22	22	22
Environmental Audit and Compliance..	18	18	20
Environmental Guidance	18	18	18
Environmental Analysis	8	8	8
Policy & Management	14	14	14
Total FTE's	125	125	127

The federal staff requirements and increase is justified in the program area narrative.

8. Capital Equipment - FY 1987 Request $2,100,000

	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request
	($'s in thousands)		
Capital Equipment	$1,443	$1,443	$2,100

FY 1987 Request $2,100,000

The FY 1987 Departmental request for capital equipment is $2,100,000 for the Environment, Safety and Health (ES&H) program and represents a $657,000 increase over the FY 1986 budget level. This equipment funding is in support of the ES&H programs' operating activities conducted at 7 national laboratories and 16 dedicated Department-wide contractors. A wide variety of capital equipment is required to pursue the diverse program of emergency response, research, and assessment of environment, safety, and health impacts of energy production, research and development. The variety and complexity of research conducted requires specialized and sophisticated equipment, and the necessity to maintain state-of-the-art capability to support the research and assessment activities makes it necessary that equipment funds be provided.

The request for Nuclear Safety will provide replacement equipment for the five aircraft which are the cornerstone of DOE's emergency response resources, as well as minimal critical additional and replacement equipment for the associated remote sensing laboratories providing radiation detection and data reduction equipment for use in aircraft, vans, all-terrain vehicles, and supporting facilities. These data indicate the extent and concentration of surface depositions due to effluents from DOE operations at both nuclear and non-nuclear facilities. Equipment is also needed in support of critical instrument and dosimeter development programs designed to assure DOE conformance with national regulations and standards for radiation protection of workers. These include the development of improved dosimetry systems for neutron, beta, photon (x-ray) extremity, and internal doses. Major items to be purchased include increased sensitivity spectral analyses equipment, and an "interface control module" for track etch processing and reading. (DOE is scheduled to replace all current worker neutron dosimeters in FY 1987 with a new type utilizing the track etch technique which will greatly improve our ability to assess worker exposure to neutrons.)

The equipment request for Operational Safety and the Assistant Secretary's support staff will provide expansion of the operating system for the Safety Performance Measurement system and associated disk drives for memory to accommodate data handling capability for increased loads on six primary modules of the system; continue upgrading of existing instrumentation to support onsite chemical analysis for hazardous substances, and necessary instrumentation required to initiate a new study to evaluate the efficacy of loaded HEPA filters under fire attack.

Equipment funds are requested to attain full operation of a computer-assisted information tracking system for environmental and safety data to monitor compliance and progress in completion of corrective actions.

The request for Environmental Analysis will provide capital equipment funds to be used by both headquarters and the National Laboratories. These funds are needed to complete standardization of ADP systems so that all field organizations and headquarters groups involved in acid rain analysis have the maximum communication potential and ability to share software and data. In addition, this equipment will be used by laboratory/headquarters analysts in excercising the new environmental residuals projection models. Equipment procured will include disk and tape drives, plotters, and other peripheral devices dedicated to Environmental Analysis projects and software packages necessary for system-wide standardization.

The increase over the FY 1986 budget level is required to purchase computer peripheral equipment to implement a computer assisted information tracking system; provide adequate replacement equipment to support the national resource maintained by the Department to respond to incidents involving radioactive materials; and provide equipment for the DOE radiation measurement accreditation program.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
OPERATING EXPENSE FUNDED PROJECT DATA SHEET
ENVIRONMENT, SAFETY AND HEALTH

Energy Supply Research and Development
Environmental Audit and Compliance

Environmental Survey Project DOE Sites	Total Estimated Cost (TEC) $60,000,000

Environmental Survey
DOE Sites

Total Estimated Cost (TEC): $60,000,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

	Cumulative Prior Years	FY 1985 B/A	FY 1986 B/A	FY 1987 B/A	FY 1988 B/A	Total Cost B/A a/
Operating expenses (DOE):						
Survey of Sites	0	0	1,500	2,000	1,500	5,000
Sampling and Analysis	0	0	6,000	28,000	21,000	55,000
Capital equipment	0	0	0	0	0	0
Total Operating Expenses	$ 0	$ 0	$ 7,500	$30,000	$22,500	$60,000
Other DOE funding:	0	0	0	0	0	0
Total DOE funding:	0	0	7,500	30,000	22,500	$60,000
Non-DOE funding:	0	0	0	0	0	0
Total funding	0	0	$7,500	$30,000	$22,500	$60,000 a/

a/ The initial Environmental Survey of the 40 sites will be completed in late FY 1988; however, there will be a continuing program of regular environmental audits in FY 1989 and future years to monitor progress of corrective actions and to ensure compliance with environmental laws and regulations.

Environmental Survey
DOE Sites
Total Estimated Cost (TEC): $60,000,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

Description, Objective and Justification

The Environmental Audit and Compliance Program was initiated in FY 1986 as a principal element of the Secretary's plan to strengthen the Department's Environment, Safety and Health Programs. The goal of the Program is to ensure that the Department's operating facilities are in compliance with all applicable environmental requirements and to reduce areas of existing environmental risk. This is accomplished through a number of activities which include: a one-time baseline Environmental Survey of all DOE operating facilities followed by a continuing program of regular environmental audits of all operating facilities; a continuing process of evaluating compliance needs and establishing budget priorities DOE-wide; evaluations and recommendations concerning the selection of corrective measures; and continuous tracking and monitoring of compliance progress from initial identification of needed corrective measures through completion and operation of such measures.

As Secretary Herrington stated in September 1985 on announcing these new initiatives: "While the record of the department in this area has generally been a good one, I want to be certain that this department looks ahead to the many challenges of the future with a strong and aggressive program in place to meet our commitments to a clean environment, public health and safety. Some of our facilities have been in use for nearly 40 years and we have learned a great deal about conducting hazardous activities. The environmental problems we are finding now at DOE facilities are, for the most part, legacies from the past, from activities conducted in a different atmosphere and under different standards than today's. What was acceptable in 1945 is not acceptable in 1985. For these reasons, shortly after becoming Secretary of Energy I ordered a thorough review of this department's environment and safety functions. I do not intend to let today's activities create problems for tomorrow. We must apply the sophisticated knowledge and techniques that we have acquired to our daily operations. This is my personal commitment to a quality environment and to the safety of our workers and all Americans. It is my pledge that the Department of Energy will be dedicated to correcting environmental problems we have now and establishing a framework for addressing environmental problems in the future."

Project Description

The Survey Program covers all media, i.e., air, water, and soil, and all areas of environmental regulation, e.g., the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation, and Liability Act. The Survey Program also covers all DOE programs and major operating facilities and involves a baseline survey of approximately 40 DOE sites at which there are an estimated 600 inactive waste areas, 300 hazardous waste management areas, 1800 air emission stacks, and 400 wastewater outfall pipes.

The environmental baseline survey of a site is conducted by a multidisciplinary team of specialists headed by DOE ES&H personnel. There are 5 survey teams with 7 to 10 members on each core team. The core teams are supplemented, for sites with a large number of inactive waste disposal areas by additional 2 or 3-member components specialized in the assessment of such areas. The team leader and assistant leader for each team are Federal ES&H employees, who are supported by technical experts from the National Laboratories and contractors.

A major cost component of the baseline survey is preliminary sampling and analysis sufficient to determine the existence and seriousness of environmental problems at DOE sites. Most of the preliminary sampling and analysis activity is directed at the Department's inactive waste disposal areas.

Schedule of Planned Activities

	Start	Complete
Initial 5 sites to be surveyed and sampled	8/86	11/86
Next 20 sites to be surveyed and sampled	12/86	9/87
Final 15 sites to be surveyed and sampled	11/87	11/88

Management and Contracting

The Environmental Audit and Compliance office has an existing contract with the NUS Corporation to assist the federal staff in gathering preliminary data on each site, participating as technical team specialists on the survey teams, and analyzing the voluminous site data and the sampling data. A follow-up new contract for site survey support is anticipated in late FY 1986/early FY 1987. The site sampling and analysis for each site is expected to be accomplished by the DOE multi-program national laboratories which will be EPA-certified to ensure maximum confidence in the site sampling analyzed data.

Current Year Achievements (FY 1986)

Implement the Environmental Survey by completing all necessary planning and preparatory activities and initiating the environmental baseline survey for the first group of 5 sites. Planning and preparatory activities include: assembling a staff; procuring support services; analyzing available site information; developing an implementation plan and schedule for the survey; developing detailed site survey plans for each of the five sites to be surveyed; developing survey procedures; developing sampling procedures; developing risk assessment methodologies and criteria for establishing budget priorities; and developing a database for recording and managing the survey results.

Cost Estimates

	Total Cost
o Survey of Sites	
- Preliminary Assessments (Information Analysis 600 areas @ $5,000/area	$5,000
- Audit of Records, Contractor Personnel interviews as necessary to determine problem areas (does not include sampling/analysis): 40 DOE sites @ $50,000/DOE site)	
o Sampling and Analysis	
- (CERCLA, 200 inactive waste areas @ $200,000/area)	$40,000

- (Clean Water Act, 100 samples/ site x 40 sites @ $1000/sample);	$15,000
- (Clean Air Act, 40 sites @ $50,000 /site);	
- (RCRA, 50 land disposal areas @ $180,000/area)	
Total Estimated Cost	$60,000a/

a/ The initial Environmental Survey of the 40 sites will be completed in late FY 1988; however, there will be a continuing program of regular environmental audits in FY 1989 and future years to monitor progress of corrective actions and to ensure compliance with environmental laws and regulations.

Incorporation of Fallout Shelters

Not Applicable

Federal Compliance with Pollution Control Standards

This project will contribute to compliance by identifying environmental risks and corrective actions, and follow-up to ensure that corrective measures are completed.

Evaluation of Flood Hazards

Not Applicable

Environmental Impact

No Environmental Assessment is necessary for the Survey effort. Full NEPA documentation will be prepared before corrective actions are budgeted and started.

Liquified Gaseous
Spill Test Facility

Department of Energy
FY 1987 CONGRESSIONAL BUDGET
MAJOR ACTIVITY OVERVIEW

Liquefied Gaseous Fuels Spill Test Facility

Background

The public as a whole derives direct and indirect benefits from the production and use of liquefied gaseous fuels (LGFs). These benefits accrue from a wide range of uses including transportation and domestic fuels, fertilizers, and feedstocks for numerous industrial processes. Industries that supply these materials have developed sophisticated safety technology and procedures as a result of many years of operational experience and the controlling influence of industry-generated standards and government regulations. However, it is clear that benefits derived from using LGFs are accompanied by a finite level of risk if they are accidentally released or improperly handled. The potential hazards associated with accidental LGF releases include burns, asphyxiation, fire, explosions, and toxic effects.

In the last decade several large research and development programs addressing LGF concerns and many smaller related efforts have been conducted by industry and government organizations in the U.S., Europe, Japan and other countries. In 1977, the Department of Energy (DOE) assumed lead agency responsibility for government-sponsored research on the safety and environmental control of liquefied natural gas (LNG). As this program developed, its scope was enlarged to address safety issues of other materials with potential hazards similar to those of LNG, including liquefied petroleum gas (LPG), ammonia (NH_3), and hydrogen (H_2). This effort was known as the DOE Liquefied Gaseous Fuels (LGF) Safety Research Program, and was the culmination of the Government's effort to protect public health and safety as well as the environment from the potentially hazardous effects of these materials.

The DOE LGF Safety Research Program has been a principal contributor to the body of new knowledge of LGF release behavior and hazards. During its brief history, the Program significantly increased the available knowledge of LGF hazard phenomena by the execution of small- and medium-scale LNG spill tests, through the development of necessary models and background information, and performing release prevention and control assessments. This knowledge has practical application as a basis for regulatory decisions, industry actions, and public information relating to LGF safety issues.

Additional research and testing is required to determine the effects of LGF spills of larger quantities and higher spill rates, and to obtain data on other hazardous materials. A Congressional initiative to provide a permanent Spill Test Facility to conduct this research was approved in September 1982 and funds were included in the FY 1984 Appropriation Bill. The Nevada Test Site was designated for construction of the Liquefied Gaseous Fuels Spill Test Facility to be located at the Frenchman Flat area. The Spill Test Facility will permit for spill tests at larger volumes and will allow safety research on a broader range of hazardous materials.

Program Goals and Objectives

The overall goals of the Liquefied Gaseous Fuels Spill Test Facility Program are:

- to design, construct, and make available on a user-fee basis a facility suitable for conducting spill tests of liquefied gaseous fuels and other toxic liquids, and
- to promote the development by users of liquefied gaseous fuels and toxic liquids, of an experimentally-verified technical data base that will aid in the prevention, mitigation, cleanup, and prediction of environmental effects of spills of these materials.

When complete, the Facility will provide the test bed for the development of safety and environmental control information needed by government regulatory agencies, industry, and the general public to assure the protection of the public health and safety as well as the environment from the potentially hazardous effects of liquefied gaseous fuels and other toxic liquids. Specific objectives under these goals include:

- Development and validation of LGF release behavior in sufficient depth to provide a firm technical foundation for development of industry standards and promulgation of regulations.
- Investigation, development, and validation of methods for preventing accidental LGF spills.
- Investigation, development, and validation of methods for controlling the consequences of accidental LGF releases.

Operation of the Test Facility by the Federal Government on a cost recovery basis for users is key under these goals.

Experimental testing is required to better understand the phenomena and physical effects associated with accidental releases of LGFs and the technology needed to mitigate or prevent such releases. Results of larger volumes and rates of release under simulated conditions are the prime purpose for constructing and making available the Spill Test Facility.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
LIQUEFIED GASEOUS FUELS SPILL TEST FACILITY
FOSSIL ENERGY RESEARCH AND DEVELOPMENT

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986[1] Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
Liquefied gaseous fuels spill test facility					
Operating expenses	$ 399	$ 1,732	$ 1,732	$ 1,200	$ -532
Construction expenses	3,900[2]	...	...	...	...
Subtotal	4,299	1,732	1,732	1,200	-532
Total					
Operating expenses	399	1,732	1,732	1,200	-532
Construction expenses	3,900	...	...	...	...
Liquefied gaseous fuels spill test facility	$ 4,299[3]	$ 1,732	$ 1,732	$ 1,200	$ -532
Staffing Total FTE's: Direct ...	0	0	0	0	0
Indirect .	0	0	0	2	+2

1/ Adjustments to the FY 1986 Appropriation are shown on the table on the following page.

2/ Cognizant Congressional committees approved the reprogramming of funds within the Energy Supply Research and Development (ESR&D) appropriation to provide an additional $2.4 million to complete the construction of the Liquefied Gaseous Fuels Spill Test Facility. The $3.9 million includes $1.5 million of the $2.0 million appropriated in FY 1985 for operating expenses.

3/ The FY 1985 amount reflects offsets of $101,000 for management initiative savings and $2,400,000 in prior year funds reprogrammed from other activities within the ESR&D appropriation.

Authorization: Section 4, P.L. 93-577
Section 301, P.L. 95-91

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer.	Gramm-Rudman-Hollings	Total
Liquefied Gaseous Fuels Spill Test Facility			
Operating Expenses	$1,800	$-68	$1,732
Total, Liquefied Gaseous Fuels Spill Test Facility	$1,800	$-68	$1,732
Operating Expenses	1,800	-68	1,732

Summary of Changes

FY 1986 Appropriation enacted	$ 1,732
Program increases and decreases:	
Liquefied Gaseous Fuels Spill Test Facility	
o Retain core scientific personnel at FY 1986 level in order to continue to provide adequate technical support to the Nevada Operations Office Manager	-532
FY 1987 budget request	$ 1,200

Liquefied gaseous fuels spill test facility:

Goals/Objectives:

The overall goals of the Liquefied Gaseous Fuels Spill Test Facility are:

- o to design, construct, and make available on a user-fee basis a facility suitable for conducting spill tests of liquefied gaseous fuels and other toxic liquids, and
- o to promote the development by users of liquefied gaseous fuels and toxic liquids, of an experimentally-verified technical data base that will aid in the prevention, mitigation, cleanup, and prediction of environmental effects of spills of these materials.

The facility will provide the test bed for the development of safety and environmental control information needed by governmental regulatory agencies, industry, and the general public to assure that protection of the public health and safety as well as the environment from the potentially hazardous effects of liquefied gaseous fuels and other toxic liquids. Specific objectives under these goals include:

- o Development and validation of LGF release behavior in sufficient depth to provide a firm technical foundation for development of industry standards and promulgation of regulations.
- o Investigation, development, and validation of methods for preventing accidental LGF spills.
- o Investigation, development, and validation of methods for controlling the consequences of accidental LGF releases.

FY 1986 Accomplishments:

- o Complete spill test facility construction to accommodate FY 1986 optional "test window".
- o Provide for the availability of the test facility on a user-fee basis.
- o Provide policy guidelines for operation and maintenance of facility.
- o Consumate agreements with organizations such as DOT, GRI, Chlorine Institute and Dow Chemical for experimental testing at the facility.

Budget Request By Subactivity:	FY 1986 Approp.	FY 1987 Request	Net Change
Liquefied gaseous fuels spill test facility	$ 1,732	$ 1,200	$ -532

The Liquefied Gaseous Fuels Spill Test Facility Program has significantly increased the available knowledge of liquefied gaseous fuels (LGF) hazard phenomena through the successful execution of small and medium-scale liquefied natural gas spill tests. These tests led to the development of necessary models, established a basis of background technical information and provided the information required to conduct release prevention and control assessments. This knowledge has practical application as a basis for regulatory decisions, industry actions and public information relating to LGF safety issues. In 1982, the House Appropriations Subcommittee on Energy and Water Development proposed funding for the construction of a Liquefied Gaseous Fuels Spill Test Facility where tests could be performed on hazardous chemicals and liquefied gaseous fuels. Following Congressional action on the Continuing Resolution (P.L. 97-377), funds were allotted for the construction of the facility on March 1, 1983.

During FY 1984 and FY 1985, a site was selected for the facility (the U.S. Department of Energy's Nevada Test Site), detailed design was completed and construction begun. Anticipated accomplishments for FY 1986 include: completion of construction, facility "shake-down", and user-sponsored testing.

The Department of Energy's (DOE) Liquefied Gaseous Fuels Spill Test Facility (LGFSTF) at the Nevada Test Site (NTS) will be capable of the rapid release of large quantities of cryogenic or pressurized flammable or toxic materials. The facility is being built in concert with and in response to the needs of many industrial and governmental organizations.

The facility is designed to satisfy the need for information for risk assessment, emergency response, regulation, plant design, plant siting, and hazard mitigation. It will be capable of spilling up to 200 m^3 (53,000 gal.) of cryogenic fluids such as Liquefied Natural Gas (LNG) or refrigerated ammonia at rates between 5 and 100 m^3/min. (1,000 - 26,000 gpm). In addition, up to 90 m^3 (24,000 gal.) of ambient temperature materials such as Liquefied Petroleum Gas (LPG) or chlorine, with pressures up to 2000 kpa (300 psi), can be released at rates between 2 and 20 m^3/min. (500 - 5,000 gpm). An extensive sensor and data acquisition system is available to acquire data on spill characteristics such as rate, volume, temperature, and pressure; downwind gas concentration and aerosol characteristics; meteorological parameters; and blast or fire effects.

The Frenchman Flat area of the NTS provides a uniquely favorable environment in which to perform large-scale atmospheric dispersion tests. Steady winds from the southwest occur with great regularity during the summer months for a variety of atmospheric stability conditions. Large-scale tests with toxic materials are possible because only limited access, federally controlled land is present for some 60 km (40 mi.) downwind.

The potential hazards associated with accidental Liquefied Gaseous Fuels releases can be divided into several areas of concern. These include:

1. Vapor generation and dispersion - The generation of vapors represent a significant threat of explosion.
2. Fire - Four types of combustion phenomena may occur in a spill; ignition, vapor cloud burn-up, pool fired, and detonation.
3. Flame propagation - Deflagration or detonation may occur after a spill, releasing large amounts of thermal energy. Deflagration is the spread of a flame front rapidly but subsonically through a fuel/air mixture. Detonation is the propagation at supersonic velocity.
4. Scale effects - Transportation of LGFs are projected to occur in large quantities. The concentration of very large quantities may lead to spills thousands of times larger than previously encountered.
5. Environmental and ecological impacts - the accidental release and dispersion of LGFs may be detrimental to the surrounding environment by threatening large-scale destruction of plant and animal life.
6. Human health impacts - LGFs contain high concentrations of toxic materials which may be hazardous to human health.

Experimental testing is required to better understand the phenomena and physical effects of the above hazards associated with accidental releases of LGFs and the technology needed to mitigate or prevent such releases. Results of larger volume and rates of release under simulated conditions are the prime purpose of constructing and making available the Spill Test Facility.

Funding in FY 1987 will provide a bridge from the current DOE program to one supported by industry and other government agencies. It will provide the fiscal flexibility needed to assure program continuity and facility responsiveness on a timely basis to user sponsored testing activities. It is anticipated that most of this funding associated with maintaining facility responsiveness and continuity will be offset with funds made available by the users for whom testing is conducted. A minimum number of key scientific personnel would be retained for the purpose of conducting tests, data collection and reduction, and test results and analysis.

Also, funding will be used to organize those activities necessary for insuring successful annual facility check-out and start-up, to establish credibility with potential customers, and to aid in the development of specific plans and products for those customers.

Once the demand for service is established, the cost of the core research team and other services will eventually be financed by user-payments. By FY 1988, sponsors of work at the facility should be paying for all of the facility related expenses. It is therefore recommended that contingency funding be budgeted in FY 1987 to insure continuity in the program and not disbanding the core group while scheduling customers in FY 1987. This funding is expected to be recaptured through the application of user fees in that year.

Facility preventive maintenance is estimated to cost approximately $200,000 per year, and will include such activities as assuring weather protection for building and tank farm control and operative devices; repair and replacement of minor failed system components; establishment and maintenance of a spare parts inventory; initial "test season" check-out and calibration of instrumentation and control systems; and "off-season" surveillance and access control.

A continued federal effort, at this time, will allow the Government to participate in and be responsible for a socially useful project devoted to the public safety across a wide spectrum of activities, i.e., transportation, utilities, petro-chemicals, gas, oil, etc.

Biological and
Environmental Research

DEPARTMENT OF ENERGY

FISCAL YEAR 1987 CONGRESSIONAL BUDGET REQUEST

ENERGY SUPPLY RESEARCH AND DEVELOPMENT

VOLUME 3

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

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DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
PROGRAM OVERVIEW

Biological and Environmental Research

The budget request for FY 1987 for the Biological and Environmental Research (BER) program is $196,565,000. Within this budget, $184,565,000 is for operating expenses, $8,500,000 for capital equipment, and $3,500,000 for construction. This request will allow continuation of the current year program activities and enhanced efforts on the health effects of environmental radon.

The mission of the Department of Energy in energy research and national defense has brought with it major responsibilities and opportunities in the life sciences. The responsibilities stem from concerns that the energy technologies which contribute so substantially to the material well being of the American people, may also have adverse health and environmental impacts. The opportunities arise because many of these same technologies, and the intellectual and physical resources underlying their development, have made major contributions to the health and welfare of society, and hold promise for even greater contributions in the future. Thus opportunities and danger are both present, and a central goal of the Biological and Environmental Research program (BER) is to maximize the former while helping to minimize the latter.

A central objective of the Department's health and environmental effects research is to create a knowledge base that will permit a realistic assessment of the impact of energy strategies before they are adopted. The accumulation of such knowledge requires long term research that is comprehensive and multidisciplinary in its scope, and quantitative and mechanistic in its level of understanding. Health and environmental effects research sponsored by the Department and its predecessor agencies has ranged from pioneering molecular investigations of such fundamentally important processes as DNA damage repair mechanisms, through systemic studies such as those that provided the earliest information on bone marrow transplantation, to the investigation of global processes that govern atmospheric transport.

These studies, and many others like them, were originally motivated by an effort to understand the effects of radiation on human health, and the mechanisms by which radionuclides move through the environment and the food chain. They have, however, had consequences which far exceed the original programmatic goals. Thus, the ability to identify and quantitate repair enzymes has led to major new insights into the genetic determinants of susceptibility to certain types of cancer with the discovery of increased risk in deficient populations. Research of this type, on molecular markers for susceptibility and resistance, is spawning a major subfield of molecular biology. Similarly, the basic research on bone marrow transplantation has provided much of the information upon which modern organ transplantation rests; while the research on atmospheric physics and chemistry has turned out to be central to approaching problems such as acid rain and changes in the atmospheric concentration of "greenhouse" molecules, which are currently of major concern to society.

Research in molecular epidemiology on understanding the molecular basis of diathesis and resistance to damage by radiation and toxic chemicals, will receive increased emphasis. The identification of populations that are particularly susceptible or resistant to certain types of insults is not only of the greatest significance to medical sciences, but it will have a major positive impact on the Department's mission by permitting an approach to setting health standards that takes account of population heterogeneity at the doses to which human populations are ordinarily exposed. Similarly, the extraordinarily high quality research on atmospheric processes, which is providing the insights needed to develop optimal strategies for addressing energy related and national defense problems, will be strengthened. Other environmental programs also require strong support as evidenced by the large number of recently published reports that describe the health and environmental issues of the day. These are most comprehensively discussed in the Report on Long Term Environmental Research and Development of the Council of Environmental Quality (March 1985). For example, models of transport and chemical reaction in soil are crucial to rational decisions related to citings of toxic waste dumps and to optimal decisions on mitigation measures to correct past mistakes. The difference between optimal strategies based on knowledge gained through research, and far from optimal strategies, amounts to hundreds of billions of dollars in economic and health costs.

One of the extraordinary characteristics of the BER program is its comprehensiveness: the global nature of its scope--compelled by its mission--is unique to the nation and perhaps to the world. This breadth makes it ideally suited to carry out certain types of programs. An example of immediate societal concern is radon research. Recent information indicates that the potential exposures to radon gas and its daughter products in residential structures, and the number of people so exposed, may by substantial. A precise definition of the risk to health presented by these exposures, and the formulation of a rational strategy for the abatement of the risk, requires the entire spectrum of activities sponsored by the BER program. Thus, fully addressing the issue of radon health effects will require the development and testing of models of radon transport through the environment, carefully controlled epidemiological studies, and fundamental studies of the mechanisms by which radon produces damage. The first of these will permit the prediction of indoor radon levels and its state of aggregation from measurements exterior to a home; the latter two will provide information on the risk associated with a given level of radon.

This brief description indicates that the BER programs aimed at addressing the health and environmental impacts of energy strategies have led to fundamental scientific advances with major implications for human health and the economy that far exceed the goal of identifying potential hazards. There is, however, an additional and equally important component to the program's goal that is related to the unique capabilities of the Department of Energy.

The Department, by virtue of its role in the physical and engineering sciences, has extraordinary interdisciplinary capabilities, and unique capital intensive equipment. These capabilities have been widely recognized. In FY 1985, other Federal, state, and local agencies and private industry invested over $115,000,000 at these facilities for the conduct of health and environmental research to help address their mission needs. Many BER-funded scientists in the onsite laboratory program also hold academic appointments and serve as an important resource in the formal education of the nation's scientists, engineers, and physicians. The research projects supported at the laboratories and universities serve as vehicles for the training of hundreds of predoctoral students and post-doctoral investigators. Opportunities are provided for research collaboration by full-time visiting scientists. Finally, the unique facilities and research instrumentation annually attracts over 600 part-time users from the scientific community.

This combination of unrivaled physical and intellectual resources has led to major advances in medicine, and holds promise for equally important contributions in the future, both in medicine and biology. Historically, the focus has been on nuclear medicine: the development and application of non-invasive imaging techniques for diagnosis and treatment of disease, and the production of radionuclides and radiopharmaceuticals for the treatment of tumors, and for the study of metabolic and other kinetic processes. Through collaborative programs with university and private hospitals, applications are pursued through the clinical feasibility stage, and into the technology transfer process. The advances made in this way have helped cure or alleviate the sufferings of hundreds of thousands of people throughout the world and have spawned industries with markets valued at hundreds of millions of dollars per year. For example, Thallium 201 alone was administered to several hundred thousand patients in 1981 for the diagnosis of heart disease and its use has saved over $78,000,000 per year in medical expenses.

The future is equally promising with such new developments as magnetoencephalography which will permit the study of neurological processes with previously unattainable precision; with the promise of neutron capture therapy for treating cancer, and with the spectacular success of heavy ion therapy for curing small and otherwise untreatable brain lesions. Important new approaches are also being pursed which show great promise for the prevention and treatment of ischemic heart disease by measuring subtle changes in regional metabolism of heart muscle before and after interruption of coronary bloodflow.

Another development which emerged from the nuclear industry is the cell sorter; an instrument originally intended to separate radiation damaged cells from normal cells. Its impact has, however, far exceed the most optimistic justifications for its development. Rapid cell sorting capabilities have had a major impact on cytology, immunology and cell biology in general and have spawned a major new industry. Among its routine uses are blood cell counts, detecting genetic abnormalities and monitoring cancer treatment. More recently, improvements in the method have permitted the creation of a chromosome specific DNA library which scientists believe will advance the course of human genetics by a decade; an advance which will certainly be a major step forward in the diagnosis and treatment of genetic diseases.

Numerous other examples of major achievements in measurement concepts and devices, originally motivated by highly circumscribed needs, have been documented in a recent BER publication. Their impact on medicine, biology and the environmental sciences have been substantial; their impact on the economy alone more than pays back the cost to the taxpayers of the BER program and its predecessors.

In addition to the intellectual and scientific resources which have made these technologies possible, the national laboratories possess multiuser facilities that are having a major impact on elucidating the structure of biological molecules. Such structural determinations are required for a rational approach to a variety of molecular design problems; e.g., the modification of proteins so that they have a specified type of activity. Moreover, the unparalleled computational resources and the broad capability to exploit them fully, also provide the environment necessary for major advances in predictive capability for small molecule structure-activity relations, which is central to problems in identification of mutagens and carcinogens, and the design of drugs and vaccines. The development of rational approaches to drug design and protein engineering can lead to commercial markets with enormous health and economic impact. Together, these structural biology activities will provide the firm foundation crucial to maintaining America's competitive advantage in private sector biotechnology during the coming decades.

The BER program budget request includes funds to support 89 FTE's at the Environmental Measurements Laboratory. The staff are Federal employees doing research in the areas of ecology, instrumentation and analytical development. This is a Government-owned, Government-operated facility, with complete laboratory capabilities.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ENVIRONMENTAL R&D
ENERGY SUPPLY RESEARCH AND DEVELOPMENT

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
Environmental R&D					
Operating Expenses					
Biological and Environmental Research	$174,405	$166,237	$166,237	$180,965	$+14,728
Program Direction......	3,475	3,129	3,129	3,600	+ 471
Subtotal............	177,880	169,366	169,366	184,565	+15,199
Capital Equipment.......	7,141	7,457	7,457	8,500	+ 1,043
Subtotal............	7,141	7,457	7,457	8,500	+ 1,043
Construction............	2,725	3,127	3,127	3,500	+ 373
Subtotal............	2,725	3,127	3,127	3,500	+ 373
Total					
Operating Expenses......	177,880	169,366	169,366	184,565	+15,199
Capital Equipment.......	7,141	7,457	7,457	8,500	+ 1,043
Construction............	2,725	3,127	3,127	3,500	+ 373
Environmental R&D......	$187,746 a/ b/	$179,950 b/ c/	$179,950 b/ c/	$196,565	$+16,615
Staffing Total FTE's:					
Headquarters...........	53	53	53	53	---
Field..................	90	89	89	89	---
Total..................	143	142	142	142	---

Authorization: Section 103, P.L. 93-438, Section 203, P.L. 95-91.

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a/ FY 1985 total does not include $1,650,000 transferred to the SBIR program. FY 1985 total reflects a reduction of $530,000 for ADP general reduction.

b/ Totals reflect a reduction of $2,455,000 in FY 1985, $2,735,000 in FY 1986, and $3,074,000 in FY 1987 for management initiative savings.

c/ FY 1986 total reduced by $7,071,000 in accordance with P.L. 99-177, the Balanced Budget and Emergency Deficit Control Act of 1985 (Gramm/Rudman/Hollings).

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer. (1)	General Reduction (2)	Management Initiatives (3)	Pay Cost Restoration (4)	FTE General Reduction (5)	Gramm-Rudman-Hollings (6)	ES&H Transfer/ Reprogramming (7)	Subtotal (8)	Comparability Adjustments (9)	Total (10)
Environmental R&D										
Biological & Environmental Research										
Operating Expenses Biological and Environmental Research	$174,700	$ -1,000	$ -935		$ —	$ -6,528		$166,237		$166,237
Program Direction	3,600	-251	—		-93	-127		3,129		3,129
Subtotal	178,300	-1,251	-935		-93	-6,655		169,366		169,366
Capital Equipment	7,750					-293		7,457		7,457
Contruction	3,250					-123		3,127		3,127
Subtotal, Biological and Environmental Research......	189,300	-1,251	-935		-93	-7,071		179,950		179,950
General Reduction:										
Operating Expenses	-1,251	1,251								
Capital Equipment										
Construction										
Total, General Reductions	-1,251	1,251								
Management Initiatives:										
Operating Expenses	-935		935							
Capital Equipment										
Construction										
Total, Management Initiatives	-935		935							
Total, Biological & Environmental Research.......	187,114				-93	-7,071		179,950		179,950
Operating Expenses	176,114				-93	-6,655		169,366		169,366
Capital Equipment	7,750					-293		7,457		7,457
Construction	3,250					-123		3,127		3,127

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
BIOLOGICAL AND ENVIRONMENTAL RESEARCH

(In thousands of dollars)

1986 Appropriation enacted	$ 187,021
1986 Gramm-Rudman reduction	- 7,071
1986 adjusted	179,950
o Continue analytical characterization in support of complex chemical studies; enhance occupational health research; maintain development of advanced radiation and chemical instrumentation	+ 1,761
o Sustain field and laboratory studies on transport and transformation of radionuclides, organics and trace elements through atmospheric, terrestrial and aquatic media	+ 3,010
o Maintain epidemiologic studies; expand automated health effects detection system; continue studies of biological markers, and long-term experimental radiation and complex chemical mixtures research.	+ 8,237
o Expand molecular biology research, especially gene library work; accelerate structural biology efforts re pulsed neutron sources; continue cell biology and chemical physics research	+ 1,917
o Sustain carbon dioxide research program of data collection, measurement and modeling; implement a few high priority research recommendations from state-of-the-art report	+ 994
o Curtail development of new nuclear medicine procedures through production and labeling of new radionuclides, instrumentation advancement, and demonstration of clinical feasibility and extend techniques to elucidate the basis for mental disease and normal brain and heart functions	- 1,191
o Increase program direction for increased personnel costs	+ 471
o Emphasize support for capital equipment and construction needs	+ 1,416
FY 1987 budget request	$ 196,565

	FY 1985	FY 1986	FY 1987 Request
Biological and environmental research..............	$187,746	$179,950	$196,565
1. Late Effects on Health and Environment of Energy Development and Use			
a. Source and Dose Determination...............	15,656	14,810	16,571
b. Environmental Processes and Effects.........	32,383	29,867	32,877
c. Health Effects..............................	63,424	57,710	65,947
d. General Life Sciences.......................	28,535	27,953	29,870
2. Nuclear Medicine.............................	21,335	23,311	22,120
3. Carbon Dioxide Research......................	13,072	12,586	13,580
4. Program Direction............................	3,475	3,129	3,600
5. Facility Operations..........................	9,866	10,584	12,000
	$187,746	$179,950	$196,565

1. Late Effects on Health and Environment of Energy Development and Use

This component of the BER program carries out the Department's responsibility for conducting a comprehensive program of research and development on the human and environmental health effects of energy technologies and programs. The research is managed in four closely interrelated areas in order to fully encompass this complex program responsibility. The first subprogram, Source and Dose Determination, provides physical and chemical information on energy-related materials released to the environment, and develops advanced techniques for measuring exposure to these agents. The next subprogram, Environmental Processes and Effects, improves our capability for describing the transport and transformation of materials through the atmospheric, marine, and terrestrial environment and evaluates their effects on ecosystems. The Health Effects subprogram investigates the human health consequences of exposure by direct studies on human populations that have been exposed occupationally, accidentally or for medical purposes, and by research at the molecular, cellular, and experimental animal level. Underlying this targeted effects research effort is a fundamental research subprogram, General Life Sciences, which explores the mechanisms whereby physical and chemical agents interact with biological systems to produce damage and how such damage is either repaired by normal biological processes or expressed as observable end effects such as cell death, mutation or cancer.

a. Source and Dose Determination..................	15,656	14,810	16,571

Evaluation of the exposure of a human or ecological population to radiation or chemicals is the **initial step in estimating consequent health effects.** The exposure may be determined indirectly by characterizing a radiation or chemical source and tracking the agents from source to receptor population, or directly by measuring the exposure with suitable instruments. The source and dose determination program develops the necessary information and techniques to address this responsibility. **Analytical Studies** are pursued to define the chemical and physical nature of energy-related agents that may be sources of human or ecological exposure. Such agents may be direct sources of exposure in the workplace, or they may be released to the general environment with consequent general population exposure. **Dosimetry Research** is designed to improve methods for the direct determination of human exposure to energy-related agents. Research in **Measurement Science** develops the advanced radiation and analytical instrumentation required to pursue effectively the broad scope of the health and environmental effects research program.

Analytical Studies

The enhanced exposure of the general population to **environmental radon** in residential and commercial buildings due to the application of advanced energy conservation technology may result in health risks to the general public that considerably exceed those from any other energy technology. An expanded effort is planned to develop predictive models which describe indoor levels of radon and radon daughters as a function of soil concentration, porosity and permeability, of building design, and of ventilation practice. This research on the sources and transport mechanisms of radon, the properties of radon decay products in the indoor atmosphere, and the factors affecting the ultimate energy deposition in the respiratory system will be applied to health effects studies and the development of appropriate mitigation and control techniques.

Chemical characterization programs are currently defining the biologically active ingredients in complex chemical mixtures related to energy production and use. A continued orderly reduction in this effort is planned in concert with the restructuring of the chemical mixtures research program which is directed at establishing principles for predicting the health effects of such mixtures in humans.

Dosimetry Research

Accurate measurement of dose not only enables a reliable determination of individual exposure, but also provides data needed to improve work practices and to reduce worker exposure. Current dosimetry research includes radiation dosimeter development with emphasis on mixed field neutron-gamma exposures, internal and external dosimetry technology, and on techniques for assessing exposure to energy-related chemicals. A new research initiative to develop and evaluate dosimetry techniques for assessing indoor exposure to thoron (radon-220) and thoron daughter products will be pursued. In addition, enhanced studies on particle growth and size distribution on attachment rates for radon and thoron daughters and on their fate in the indoor environment will be conducted.

The important Japanese **A-bomb survivor dose reassessment** will continue at a lower level, emphasizing the completion of the overall uncertainty analysis and the final reports for all phases of the program. The dosimetry system in place at the Radiation Effects Research Foundation will be generating the definitive organ dose data needed for the establishment of human dose-response relationships. The results will be applied to the interpretation of radiation monitoring data in terms of relevant radiation protection quantities and for adjustment of protection standards if necessary.

Research is also conducted to achieve improved personnel and field monitoring systems for **determination of exposure to organics** and other chemical materials related to the nonnuclear energy technologies. Specifically, the use of monoclonal antibodies is currently being investigated as a means of determining exposure to high molecular weight organic hydrocarbons. In addition, the feasibility of measuring and monitoring changes to the DNA molecule as an indication of exposure to organic materials is being explored.

Measurement Science

Progress in chemical characterization, dosimetry research and in a broad range of environmental and biomedical investigations is critically dependent on the availability of **advanced and innovative measurement tools and techniques.** A continuing program of basic and applied research is conducted focusing on key measurement needs. In FY 1987 a phase down of research on instrumentation techniques for measurement of toxic gases and effluent pollutants will occur as existing projects are completed. New or expanded efforts are planned in semiconductor radiation detection devices, remote measurement techniques for biologically active substances, and laser spectroscopy for chemical analysis.

Basic studies on new techniques for radiation detection now emphasizes **advanced semiconductor detectors** and specialized electronic signal processing techniques to provide measurement systems with low noise, better sensitivity and high count rate capabilities. **Mercuric iodide**, in particular, has been shown to operate at ambient temperatures with energy resolution approaching that of today's best liquid nitrogen-cooled silicon detectors. Avoiding the penalties of weight, size, and complexity associated with such cooling makes these mercuric iodide systems particularly attractive for portable and remote applications. A prototype device based on BER-sponsored research at the University of Southern California has, in fact, been flown on space shuttle missions to monitor gamma ray dose to the crew.

Laser-based techniques which enable extremely sensitive and selective measurements are being employed in a variety of applications. Resonance ionization spectroscopy, particularly in combination with mass spectroscopy, continues to find important new uses. Measurement of as few as 1000 atoms of the isotope Kr-81 in groundwater has been successfully demonstrated thereby providing a means of dating samples several million years old. This information can be used to model the subsurface transport of toxic substances and to help identify potential waste disposal sites. A laser-excited solid state fluorescence technique called fluorescence line narrowing spectroscopy (FLNS) has been applied to measurement of the compounds ("adducts") formed between DNA and carcinogenic polycyclic aromatic hydrocarbons. These adducts are believed to be an early step in the development of cancer and may ultimately provide a foundation for more precise assessment of risks. The FLNS technique is so powerful that it can detect a single adduct in one hundred million DNA bases, and can distinguish between adducts formed by different carcinogens.

Research to improve the detection and measurement of hazardous chemicals has produced a technique for distinguishing very similar hydrocarbons by **negative-ion mass spectrometry.** This technique is based upon the differing electron affinities of otherwise similar compounds, i.e. their ability to capture an electron. It is now possible to distinguish biologically active compounds such as benzo(a) pyrene, a potent carcinogin, from its inactive isomer, benzo(e) pyrene, thus improving the capability for quantifying the hazardous component of complex mixtures.

	FY 1985	FY 1986	FY 1987 Request
b. Environmental Processes and Effects............	$ 32,383	$ 29,867	$ 32,877

In FY 1987, an increase is planned for atmospheric and environmental research. Funds will be used in the marine program for development of automated instrumentation to measure water chemistry and particle abundance, thereby reducing future requirements of expensive ship time. In the terrestrial area, research on radon exhalation from soils and building material will be enhanced to develop predictive models for determining radon flux under different environmental conditions and thereby allow better prediction and mitigation of indoor radon. Also, controlled field scale experiments will be initiated to provide much needed information on the use of natural systems as detoxification and mitigation filters for energy contaminants in soil and ground water.

Upon release of agents from an energy source, it becomes necessary to understand their **transport and transformation** through atmospheric, terrestrial and marine media in order to estimate the subsequent exposure to humans and the environment. This research activity dates from the early weapons testing era when information on the transport and fate of fallout radionuclides was needed. To meet this need, a comprehensive program in the physical and ecological sciences was established which today is being applied to multiple energy-related activities.

Another component of the environmental research program centers on the response of ecosystems, populations and individual species affected by energy-related disturbances and discharges. This effort aims at the anticipation of environmental impacts before they happen, and at the understanding of these impacts in order to allow the prevention or alteration of deleterious consequences.

Atmospheric Transport and Transformation

The BER program in the atmospheric sciences is concerned with the movement of energy-related pollutants through the atmosphere (transport) and their chemical and physical changes during transport until they are deposited on the earth (transformation). The FY 1987 request will sustain ongoing research programs with some additional emphasis on atmospheric organic chemistry.

A question central to the acid rain issue is the relationship between emissions in the midwest and acidic deposition in the northeast. The **"PRECP program"** (Processing of Emissions by Clouds and Precipitation) was initiated in FY 1985 to investigate the proportionality between pollutant releases, particularly SO_2 and NO_x, and the subsequent deposition of acidic species at great distances.

The PRECP program became fully operational in FY 1985. Field experiments were designed to determine the aqueous phase changes that sulfur and nitrogen compounds undergo as they are incorporated into various cloud systems. This design attempts to provide measurements of sulfur, nitrogen and other reactants in the air mass entering the cloud, in-cloud chemical changes, and analysis of the products leaving the cloud. A series of field experiments, centered in Columbus, Ohio, was carried out during April 1985. An "air cavalry" methodology was employed with various aircraft being deployed over a wide area to capitalize as much as possible on promising meteorological situations. The results of these studies and of laboratory-chemistry studies and modeling efforts will provide significant input to the major on-going National Acid Precipitation Assessment Program (NAPAP) effort to develop a comprehensive Regional Atmospheric Dispersion Model. The program in FY 1987 will emphasize analysis and interpretation of the massive data cumulated in the field experiments, and will plan field experiments in different types of storm systems.

The FY 1985 **ASCOT** (Atmospheric Studies in Complex Terrain) **experiments** in Colorado addressed valley flows and the coupling of the local flows with regional scale winds. The experiments involved a massive collection of meteorological and chemical tracer data. These data will form the basis for FY 1987 field experiments in Western Colorado. The decision has been made to extend the range of the ASCOT experiments from 10's of kilometers to 100's of kilometers and to continue to study the exchange of air masses between adjacent valley systems.

A new initiative begun in FY 1986 was the **Western Air Chemistry study.** Initially, this involved an effort to document the air chemistry of the ASCOT area and other relatively unpolluted Western regions. In FY 1987, this program will address the air chemistry of energy related emissions and their interaction with organic emissions from vegetation in the very sunny and arid atmosphere of tne West. It is anticipated that this work will be closely coordinated with other chemistry research related to the reactions of organic emissions with ambient pollutants such as SO_x, NO_x and ozone.

The data from the FY 1984 **Cross Appalachian Tracer Experiment** (CAPTEX) forms the basis for a model comparison workshop scheduled in early FY 1986. The CAPTEX data base made possible the first comprehensive comparison of long range dispersion models and as such has made a major contribution to the understanding of regional scale tropospheric transport and dispersion. Plans are being developed for additional tracer experiments on the multi-thousand kilometer scale.

The applied laboratory and field programs in atmospheric science will continue to be undergirded by a continuing **fundamental research effort** to provide kinetic and thermodynamic data measurements for important atmospheric chemical reactions.

Marine Transport and Transformation

Beginning with the study of processes that distributed radioactive fallout through the oceans into the food chain, this program has pioneered the use of natural and artificial radionuclides to determine movement and mixing rates of water masses, flushing rates and major sinks of contaminants in the coastal zone and deeper oceanic areas. In the future, the ocean will have to be seriously considered for disposal of some of the waste products generated by expansion of energy technologies. Research conducted under this program on cycling and movement of materials off our coast will provide crucial information for decisions on appropriateness for ocean disposal of these wastes.

The present program is subdivided into **three regional areas.** In the **Northeast** a 10 year research program has been planned to analyze processes that move and alter materials, from the atmosphere and surface water to the continental shelf. Called SEEP (Shelf-Edge Exchange Processes), this program examines the mechanisms that remove chemicals from the water, and the processes that cause contaminants to bind to the sediments or to be released back to the water column. The first phase of SEEP has been completed and has caused considerable excitement among oceanographic scientists because the movement of particles offshore to the continental shelf appears to be along trajectories not originally expected. The second phase (SEEP II) will be initiated in 1987.

In the **Southeast,** our marine research has discovered how Gulf Stream eddies and upwelling drive water masses and nutrients on the mid and outer shelf. These studies on Gulf Stream intrusions have been synthesized into a recent comprehensive publication on outer-shelf dynamics. Present research is being concentrated on the near-shore zone where a front of freshwater from coastal rivers exists. The SPREX (Spring Experiment) of 1986 and FLEX (Fall Experiment) in 1987 will help determine why cross shelf transport is so spasmodic in this region, and what controls the periodicity and volume of the discharge to the deeper off-shelf ocean waters. Early evidence indicates that most near-shore currents move along shore but that periodically, the trapped coastal water appears to escape seaward particularly in the spring and in the fall seasons. This research contributes to a better understanding of the removal of chemicals, wastes and other materials from the near shore region and their transport across the continental shelf.

In the deep ocean basins off **California,** a new program will investigate the vertical and horizontal movement of materials. This study will address the interaction of waste runoff materials with particles in the water and their decomposition and remineralization.

Terrestrial Transport

Research in this area has focused historically on the transport and accumulation of radionuclides and other energy materials through environmental pathways leading to humans and the migration of these materials in soil and water especially around DOE facilities. This research has demonstrated which plants and animals concentrate radionuclides and other chemicals, and which chemical, physical, and biological properties can minimize their uptake in ecosystems.

A **challenge for the next decade** will be to better understand the biogeochemical mechanisms that affect the toxicity of chemical contaminants, and the movement of these materials in subsurface environments. Specifically, information is required on the hydrological transport of organic compounds, trace metals, and radionuclides; geochemical attenuation by soils and geological strata; and uptake of contaminants by biological systems in order to understand the boundaries within which terrestrial disposal of waste is possible and environmentally acceptable. Not only costly, engineered solutions but also natural systems can provide an important link to effective disposal and detoxification. This program concentrates on natural systems as mitigation factors. Advanced technologies including supercomputers, fiber optics, and remote sensing are an integral part of this research. Beginning back in FY 1983, increased priority was given to energy-related organic contaminants, their decomposition products and movement of these constituents in the ground water. This emphasis will continue to expand through 1987.

National Laboratory-University consortia have been formulated to focus scientific resources on this important research area. In the period FY 1987 - FY 1990, controlled field scale experiments will continue to provide an essential intermediate step for larger controlled experiments at natural sites beyond FY 1990.

Ecosystem Functioning and Response

Energy production and development can affect water use and produce varying degrees of landscape disturbance. Prediction of the extent and persistence of such human-related impacts is critically important, as is the development of mitigation strategies for reducing serious impacts. Prediction and mitigation can be successful only if basic processes affecting ecosystem functioning are well understood.

Past research conducted under this program has elucidated the sulfur cycle in forested ecosystems which is now providing crucial information on acid rain. Information on carbon cycling developed with support of this program is now a central part of the evaluation of CO_2 buildup.

In FY 1986, this program focuses on the understanding of changes in ecosystems functions in relation to water stress. For example, at the DOE National Environmental Research Park at Savannah River, the existence of different radioisotopes in surface and ground waters and sediments, and comprehensive background information on hydrology and ecological systems provide a unique opportunity to conduct **research on wetland processes** at several levels of ecosystem organization.

This emphasis on water stress is also being applied to arid and semiarid ecosystems at the Nevada Test Site and the National Environmental Research Parks at Idaho Falls, Hanford, and Los Alamos, and in the extreme cold regions of the Arctic tundra. Models integrating across complex organizational levels from individual cells to ecosystems are being actively developed along with manipulative studies at these diverse sites. Thus, in addition to research at the watershed and landscape unit level, this program explores the **physiological responses of organisms to water stresses** which affect the composition and health of the communities. This hierarchical approach to ecosystem modeling has put this program in the forefront of ecological theory especially as concerns the application of quantification methodologies for the spatial patterning of landscapes.

Such research is also important for providing the basic foundation for **utilization of biotechnology techniques in the environment.** The better the knowledge of how systems work, the better is our ability to predict optimal usage of biotechnology within the environment.

	FY 1985	FY 1986	FY 1987 Request
Health Effects..................................	$ 63,424	$ 57,710	$ 65,947

The Health Effects research program provides a continuing source of information required to ensure that the operations and policies of the Department can be supported in terms of protecting the health of workers and the general public. Research in this program is designed to meet that responsibility by the development of a broad, scientifically sound data base for evaluating the potentially adverse health effects that could result from exposures to radiation and chemical agents most relevant to Department of Energy programs and operations. There are two principal subprograms. One program utilizes human epidemiological data obtained from selected human populations known to have been exposed acutely to moderately high, or to chronically low levels of external radiation, internally deposited radioactive materials, or complex chemical materials of the type that could be encountered, for example, in connection with the production or use of synthetic fuels. The other subprogram is designed to provide detailed health effects data, including data on mechanisms by which health effects are induced and expressed, which cannot be obtained from human studies. This subprogram makes use of experimental animals chosen on the basis that they are useful models for human beings. In addition, animal organ and tissue cultures, as well as animal and human cell cultures, are extensively used (1) to develop an understanding of basic mechanistic principles involved in the production of radiation and chemical effects which are applicable to most species and (2) to strengthen our capability to extrapolate experimentally-derived data to man. Both subprograms include molecular-level studies. Like other parts of the overall BER program, the Health Effects research program depends on basic biological research to provide new methods and concepts which quickly find application in both subprogram areas.

Human Health Effects

The **epidemiologic research** program comprises studies which attempt to provide needed scientific data and, at the same time, provide information of important practical significance. These studies include investigations of human populations with occupational or environmental exposure to energy-related pollutants. Among the major populations which have been under study for several years are DOE/DOE contractor workers, Japanese atomic-bomb survivors, nuclear shipyard workers, and New Mexico uranium miners. These population studies will be supplemented by studies of lung cancer cases in Pennsylvania and New York and of communities located near DOE facilities. The former studies are attempting to determine if there is a potentially causal relationship between lung cancer and residential exposure to radon gas and its progeny. The latter study utilizes previously-collected data such as the 1960, 1970 and 1980 censuses and mortality data compiled by the National Center for Health Statistics, to investigate clustering of diseases related to proximity to DOE laboratories and other operations.

During FY 1987, the results of the nuclear shipyard study will be available. These results have been anxiously awaited for some time, and are expected to greatly refine our confidence in low-level radiation risk estimates which have been developed through extrapolation from populations exposed at high doses and dose rates. Also during FY 1987, it is expected that expansion of the Health Surveillance System now operating at two DOE sites will begin to provide unique data on morbidity effects from occupational exposures at DOE facilities. Similarly, the intensive effort to characterize the industrial hygiene aspects of these facilities in order to identify chemical hazards which may be responsible for some apparently deleterious health effects that have been discovered in previous epidemiologic investigations will continue.

Biological markers research looks for those subtle changes from the normal in biological function or morphology that are associated with exposure to a pollutant of concern. Once identified, these biological markers may then be applied in epidemiology, clinical research and occupational medicine or, conversely, these fields may provide the association which ultimately identifies the marker. Ongoing efforts include a project that is correlating consistent chromosome aberrations with radiation and/or chemical exposures. This project has been expanded to identify the oncogenes involved in these aberrations, possibly leukemia genes. Another biological markers project is obtaining, by direct inspection, information on the chromosome constitution of normal human spermatozoa as well as those from men who may have been exposed to potentially harmful pollutants. This research will provide for the first time a method to analyze large numbers of human germ cells. In another study, specific locus mutations are measured directly in human sperm. It will be the first method of this kind. These interrelated efforts at the forefront of human molecular biology will continue at a slightly increased level. A new project to study cultured human cells for cytotoxic and genetic damage after exposure to indoor complex mixtures will begin in 1987.

DOE policy has long encouraged conservation techniques in both residences and workplaces. Nationwide, new building technology has gone far in implementing these policies -- at the same time, public power utilities have actively encouraged weatherization of existing structures. Assuring human health and safety in these tightened structures, a result of DOE conservation policy, is an objective of **indoor air quality research.** Efforts studying the health effects of advanced conservation techniques will continue, and further work on indoor complex chemical mixtures as well as biological aerosols in energy saving, heating and cooling systems will begin. While radon has been the most serious concern and focus of much of the human health research, these other areas remain largely unexplored by any Federal agency. Wherever possible, such research will be done in a cooperative fashion with other agencies such as the Consumer Products Safety Commission, Environmental Protection Agency, and Health and Human Services to assure maximum use of existing facilities and available funds.

An expanded radon research program will initiate several new innovative human exposure methods such as radon bioassay development. Pb-210 (Lead) in mine and mill workers has shown promise as an indicator of the integrated radon daughter exposure. A two-part study to measure Pb-210 concentrations in former mine and mill workers, while they are still alive, and preserved animal bones and bones obtained at autopsy from uranium workers will further investigate the utility of this integrator of radon daughter exposure. In addition, recent highly sensitive laser analysis techniques have been developed for obtaining data on human exposure to uranium. Radon and daughters in blood or urine are two possible indicators of current (perhaps integrated) exposure to radon and radon daughters. These biological dosimeters offer the potential of measurement of population as well as worker exposures and will be developed in conjunction with the animal experiments.

Experimental Health Effects Research - Biological Systems

The principal source of health-risk information upon which existing standards and guidelines for limiting human exposure to biologically active environmental agents are based on the analysis of increased incidences of cancer and other late-occurring diseases in human populations exposed to those or similar chemical or physical agents. It has become increasingly obvious that human data alone are inadequate to provide such information for some of the radiations and energy-related complex chemical mixtures of specific concern to the Department of Energy. Similarly, inadequate data are available for predicting human health effects resulting from exposures to combinations of toxic organic compounds and radiation, a situation that must be considered in many occupational and public exposure situations.

To meet these needs, the experimental health effects research program aims at providing health risk evaluation data from carefully controlled **laboratory-based studies** using a multispecies comparative approach encompassing multiple levels of biological complexity (animals, organs/tissues, cells, and molecules). This approach seeks predictive correlations between cellular/molecular events and whole animal responses. The program has two major thrusts; (1) to supply the kinds of quantitative experimental data that can be used as a primary source of information to assess human risk, and (2) to provide, on a continuing and progressive basis, a scientifically sound data base to remove or minimize the uncertainties that exist in developing useful human risk assessments. Two distinct but interrelated subprograms exist for meeting these goals within the restricted mission of the Department. To meet the first objective, detailed **toxicological dose-response studies** are conducted with long- and short-lived laboratory animals to provide reliable quantitative estimates of increased incidences of delayed somatic effects that result from low-level exposure to ionizing radiations or complex chemical mixtures related to energy production and use. Similar studies are also conducted to provide detailed experimental evaluation of the genetic risk for heritable mutations that could result from exposure to the same physical and chemical agents. Most of these studies attempt to duplicate the chronic, low-dose exposure conditions that might be expected to exist for occupational groups, as well as the general population, as a result of the activities of the Department. At the same time, however, **basic research studies** are carried out to evaluate the importance of exposure and biological variables, including dose-rate and age at time of exposure, in modifying risks of delayed somatic and genetic effects. This second objective is met by a subprogram which seeks to provide an understanding of the basic physical, chemical, and biological mechanisms involved in production of delayed somatic and genetic effects in mammalian cells, tissues, organ, and organisms. These latter studies are not only inherently important in establishing general biological principles in toxicology but also in establishing a sound basis for extrapolating experimentally-derived data to estimation of human health risks.

Late Effects Dose-Response Studies

The largest segment of this program involves the use of long-lived animals to provide **lifetime risk data** for induction of cancer and life-shortening by internally deposited alpha-emitting radionuclides of importance in production of fissionable material and by actinide radioisotopes as well as gamma- and beta-emitting fission products that are of concern in nuclear waste management activities of the Department. Some of these studies were initiated 7-12 years ago and the data obtained constitute a primary source of health risk information for use on a continuing basis. These programs will be adequately supported to their completion. The animal populations involved in the radionuclide studies are presently nearing the post exposure age when they will become at high risk for developing cancer. Materials taken from tumors and normal tissues of these animals provide an invaluable resource to study the relationships between molecular markers, such as **oncogenes and chromosome alterations** in radiation induced cancer. Such studies were initiated at Pacific Northwest Laboratory in FY 1985 and if successful, will be expanded in FY 1986 and FY 1987. On a multilaboratory basis, studies define the microdosimetry of deposited radionuclides and the specific target cells for cancer induction.

Increased effort will be made to better define human health risks associated with nonoccupational exposures to radioactive radon daughter products. Animal inhalation studies will focus on quantitative radon exposure - response relationships for tumor induction by radon daughters in the rodent respiratory tract. This work will be coordinated with efforts to identify unequivocally cells at risk of tumor development and to measure the absorbed radiation dose (i.e., deposition of energy) in critical cellular targets. Basic cell research will be used in conjunction with flow cytometry in work on the separation and characterization of target cells. Molecular correlates of cellular responses to radon daughters will also be evaluated, including expression of cell oncogenes. Additional animal studies will be conducted to clarify the role and importance of cigarette smoke as a factor in modifying risks from inhaled radon daughters. This research will define tumor initiating and promoting activities of radon daughters and cigarette smoke and determine if the sequence of exposure to these toxic materials may significantly affect the final biological response. Information gained from the total multilevel research effort, as planned, should improve the interpretation of human health studies and better define radon-daughter dose levels that are of concern in regard to the general population.

The major emphasis in the **external radiation studies** is devoted to better quantifications of the maximum RBE (relative biological effectiveness) of **neutrons** at low doses and low dose-rates. It is obvious now that detailed animal dose-response studies are not logistically or economically feasible for the dose range below 10 rad. New types of statistical models are being used to make the best use of existing data approaching that dose range. Such analysis now suggest that there is a linear dose-response relationship for both neutrons and gamma rays, which argues for a constant RBE in that crucial dose-range. A number of short-term _in vitro_ cell studies have been initiated to test the hypothesis of constant RBE at doses in the range of 1 rad of neutrons. There is some indication to date that x- and gamma radiation actually are "incomplete carcinogens" in that secondary factors, not directly related to the radiation itself, may determine whether or not tumors develop. These studies, when coupled with the _in vivo_/_in vitro_ cell and tissue studies described below, may resolve many of the existing questions that have been raised in the health protection community about the need to reduce the maximum permissible dose of neutrons for workers in the DOE program. These critically important studies will be accelerated in FY 1987.

Dose-response studies in short-lived animals (rodents) will continue in order to define **classes of chemicals** in energy-related complex chemical mixtures that produce late somatic effects other than cancer (e.g., congenital abnormalities, neurotoxicity, immunotoxicity). Additional dose-response studies in rodent species will be needed to validate carcinogenic and mutagenic properties previously observed in cell bioassay studies. Also, in need of validation in the mammalian organism are synergistic and antagonistic interactions that are known to occur between components of complex mixtures when examined in simple model systems. The principal goal of research in this area is to develop sufficient understanding of factors controlling the properties of complex mixtures so that toxicologic properties may be estimated from readily measured chemical and biological parameters. Hence, basic and mechanistic research is emphasized, as discussed below. In research on both radiation and chemical mutagenesis, improved methods for detecting, monitoring, and quantifying **heritable mutations** in human and animal populations is urgently needed and will be expanded. Current research in the General Life Sciences area is developing molecular techniques for characterizing molecular alterations in both genes and gene products (e.g. protein molecules). As these methods become available for routine use, they will be applied in genetic studies of exposed animals.

Mechanisms of Production of Late Effects

As was mentioned earlier, there are limited human data available for making sound estimates of human health risks associated with low-level exposure to the kinds of radiations or complex chemical mixtures of concern to the Department. This subprogram aims to reduce the uncertainties in using that limited information as well as the larger data base derived from laboratory-based experiments to obtain such estimates. The research provides a fundamental understanding of the physical and chemical reactions that can produce biological damage and the molecular and cellular changes that lead to the observed genetic and somatic effects in important target organs and tissues of mammalian species. When such studies are conducted on a comparative basis, they provide a sound basis for extrapolation of experimentally derived data to human beings.

Ongoing **research in radiological physics** will be supported on a continuing basis to supply the data needed for a quantitative understanding of the early physical events (energy deposition and transfer) which lead to important biological damage. Recent emphasis has shifted from studies of gas phase reactions to the more biologically relevant reactions in condensed systems. Also, special emphasis will continue to be given to understanding the reactions with high-LET radiations including neutrons.

In the same vein, **biological studies** will continue to provide detailed understanding of the kinds of changes in key macromolecules (notably DNA) that can result in genetic changes including those that are likely to be involved in cancer production. Special emphasis will continue to be placed on research which compares those molecular changes that result from exposure to ionizing radiations and to toxic chemicals since evidence is now accumulating which suggests that it will be possible to differentiate between the kinds of mutations and molecular damage that are produced by chemicals, ionizing radiation, and ultraviolet radiations. Such information could be extremely important for developing molecular markers that can be used to estimate mammalian exposure to chemical mixtures or radiations.

Special emphasis will be given to studies that relate **cellular/ molecular changes** in the intact animal to given exposures of ionizing radiations or complex chemical mixtures. Several "multilevel" model systems have been developed which allow direct intercomparison of cells of a given tissue in the intact animal with cells cultured in vitro. For example, cells in the tracheal epithelium, mammary gland, and thyroid gland of rodent species can be exposed to ionizing radiations or chemical agents either inside or outside of the animal and their subsequent growth and differentiation followed either in vivo (i.e., in animal body) or outside of the animal (in vitro). Similarly, cells exposed previously to chemical mixtures or radiations in culture can then be implanted into one of the animal models and followed both in vivo and in vitro to provide detailed information on the molecular changes induced by the exposing agent. This approach is being exploited in studies of both radiation and energy-related chemicals. Since this type of work meets both of the objectives of this subprogram, funds will be redirected from other parts of the research in order to accelerate these studies, particularly in the case of research on the neutron RBE problem.

Research will also be accelerated to develop a stronger base of knowledge on mechanisms of neutron interactions with biological systems. Although the biological effects of neutron are known to differ significantly from those of x- and gamma radiation, the mechanistic basis of this difference is not known. It is planned to increase effort in research on neutron interactions at the level of the gene. This work will include research on mechanisms of DNA damage and repair. Related studies will explore the possible role of chromosome damage and oncogene activation in neutron carcinogenesis.

In a related area of research, basic **studies in cultured cells and intact animals** are carried out to elucidate the mechanisms by which components of complex chemical mixtures interact in biological systems to alter toxicologic properties. Nonadditivity of toxicities (synergism, antagonism) appears to be characteristic of highly aromatic organic chemical mixtures from fossil fuels. Such nonadditive effects may be a general property of many types of complex chemical mixtures. Although well demonstrated (e.g., in fossil fuels and cigarette smoke condensate), the cellular/molecular bases for these nonadditive effects are not understood. Increased emphasis will be given to the development of model cellular/molecular systems to elucidate the principles that govern the biological interactions. Attempts will also be made to predict interactions between chemical agents and radiations simultaneously administered to target cells/tissues. Research on specific cellular and molecular markers that correlate with delayed toxicity is also emphasized because of the potential importance of such markers as predictors of toxicologic properties.

Experimental methods have been developed to characterize mutations at the chromosomal and molecular level in a large number of mutant strains of mice developed at the Oak Ridge National Laboratory (ORNL). Emphasis in early FY 1986 will be placed on screening this mammalian mutant collection for those disease phenotypes (from the mutations) that resemble known human disease.

These mutants, carried in stock at ORNL, constitute a unique research resource for studies in mammalian heritable mutagenesis. Besides being an important component of heritable mutagenesis studies of interest to this Department, the various mutant strains of mice are made available on request to other investigators, in and outside DOE, who are interested in pursuing such work.

This subprogram is fortified by the strong General Life Sciences program described below.

	FY 1985	FY 1986	FY 1987 Request
d. General Life Sciences..........................	$ 28,535	$ 27,953	$ 29,870

Research in General Life Sciences contributes to the base of fundamental biological knowledge that is required for the effective study and interpretation of energy-related health effects. It also identifies early indicators of biological damage, develops new techniques and experimental systems for research use, and provides knowledge that eventually becomes used in the estimation of human health risk. Research in this category also supports the development of new instruments to analyze biological systems and the use of special facilities at the National Laboratories, such as neutron sources for the determination of biological structure, and state-of-the-art capabilities in scanning transmission electron microscopy, that are heavily used by the academic community for research and training.

Research on normal cell processes and functions and their regulation will be strongly supported and will emphasize studies to understand how cells divide and differentiate and what factors influence or regulate them. A related problem is to understand which cellular factors influence the stability of the differentiated state and which ones may be involved in the transformation of normal cells to a malignant state. This research is related to ongoing studies of proteins on the surfaces of cells that act as part of a membrane transport system or are part of cell receptor sites which transmit hormone-borne signals from the outside to the inside of cells. Rapid advances are being made in our understanding of the manner in which a variety of hormones or chemical regulators interact with receptor sites (regulatory sites) on cell surfaces in ways that serve to control cell growth and function. Results from recent research indicate that the presence of abnormal chemical regulators in the cell environment may trigger aberrant growth leading to tumor formation. This important concept, including the possibility that abnormal chemical regulators with tumorigenic properties may be products of activated proto-oncogenes, will be vigorously investigated. Specialized cells of the immune system such as macrophages and lymphocytes are also being studied to help us understand how the immune system acts to protect the mammalian organism from the consequences of cellular damage brought about by energy-related pollutants.

Research in genetics will focus on the structure and function of the gene, its normal and mutated configurations at the molecular and chromosomal levels, and how genes with modified structures are expressed and regulated. Of particular importance are studies aimed at identifying and cloning human genes involved in repairing specific types of radiation damage. Emphasis is shifting in other research at both the animal and cellular levels toward explaining the physicochemical and molecular basis of mutations induced by various kinds of radiations and chemical agents. Of continuing interest is research on the different spectra of mutations and DNA base-sequence changes that are produced in certain animal and human cells by chemicals and radiations. Induced mutations and structural changes appear to differ from those arising spontaneously. Preliminary evidence suggests that different mutagens may differ in the spectra of structural alterations they produce in DNA molecules. Another critical area of genetics research addresses the mechanisms underlying differentiation, neoplasia, and aging. Included is research designed to elucidate the manner in which cellular "oncogenes" may be activated or amplified by carcinogenic agents. Molecular characterization of normal and mutant genes in both somatic and germinal cells of rodents, longer-lived animal species, and humans using recombinant DNA techniques and other bioengineering approaches will be emphasized.

Research in chemical physics is investigating the fundamental processes that govern the distribution of energy within biological molecules. These studies are being made in large organic and biological molecules so that the data can be applied directly toward understanding the biological effects produced by exposure to ionizing radiation or to energy-related chemical mixtures.

Important progress is being made in **biophysical research and instrumentation** directed toward the development and application of advanced systems for measuring and determining the structure of complex components of living cells. Instruments of interest include electron microscopes, flow cytometers, and advanced optical devices. For structural biology studies at the National Synchrotron Light Source (NSLS), a beam line for the vacuum ultraviolet ring has been equipped with instrumentation to study the structure of nucleic acids and proteins. A very fast, position-sensitive x-ray detector has been developed for rapid, dynamic studies of molecular structures using the x-ray ring. With these developments, studies of the structure of biological molecules have begun at both the UV and x-ray rings of the NSLS.

Recent structural studies have identified a new form of RNA, named Z-RNA, that exists in the form of a left-handed double helix in which the two component strands of the helix wind around one another in a counter-clockwise fashion. Future research will seek to determine the biological significance, if any, of Z-RNA. Another important study has produced a detailed characterization of structural alterations induced in the DNA molecule by ultraviolet radiation (UV) and by interaction with the chemical compound, psoralen, to form a crosslink between adjacent DNA strands. Both types of agents were found to produce a kink in the normally linear DNA double helix accompanied by partial unwinding of the helical structure at sites of damage. The availability of well characterized samples of damaged DNA is expected to facilitate new research on molecular mechanisms of mutagenesis.

Improvements in the resolution, machine stability, and sorting speed of flow cytometers have made it possible to sort chromosomes with better than 95 percent purity for **gene mapping** and studies of chromosome damage, and to provide DNA samples for the construction of chromosome specific recombinant DNA libraries.

Research on a prototype electronic camera system for detection of radioisotope-labeled biological molecules separated on 2-dimensional gels or chromatograms was completed. Compared to conventional autoradiography with films, the time required for analysis of 2-dimensional gel separations was reduced by a factor of 10-100 along with improved linearity and dynamic range. An improved version of the camera, now under development, should allow direct quantitative counting of most radioisotopes with a spatial resolution of 0.5 mm and will be used in genetics research.

	FY 1985	FY 1986	FY 1987 Request
2. Nuclear Medicine Applications..................	$ 21,335	$ 23,311	$ 22,120

The use of radiation and radionuclides in the study, diagnosis and treatment of human disease is the foundation of the field of Nuclear Medicine. Historically, DOE and its predecessor organizations have played a vital role in the development of this field. This development has been possible largely because of access to the unique facilities and skills in the laboratories supported by the Department of Energy. These facilities include nuclear reactors, particle accelerators and nuclear instrumentation. Moreover, the skills of nuclear physicists and nuclear chemists have been essential factors in transferring nuclear technologies to medical applications.

The objective of the FY 1987 research program is to continue the development of new nuclear medicine procedures through the production of new radionuclides, the radiolabeling of new biologically active agents, and advancements in instrumentation. Efforts to develop other medical applications using reactors, accelerators and other related nuclear technologies will be maintained.

Within the Federal government this mission and DOE's facilities for conducting research in this area are unique. Liaison is maintained with Federal agencies (principally NIH and FDA), the radiopharmaceutical industry, and the medical community regarding the requirements and effective use of these techniques in medical research and practice.

Research emphasis on **radionuclide production** in this time period will be on the development of generator systems for short-lived radionuclides. Such generator systems consist of a parent nuclide, having a half-life ranging from hours to days, which decays to a daughter having a half-life ranging from seconds to minutes. The daughter can be periodically removed from the generator for clinical use. At present, most short-lived radionuclides are produced by a cyclotron which severely limits their availability. These generator systems will permit nuclear medicine procedures to be performed in medical facilities which do not have a cyclotron on the premises. A potential new initiative in FY 1987 is the development of a cerium 134/lanthanum 134 generator which appears to be attractive for bone marrow studies. Preliminary studies with lanthanum-140 as a tracer showed a high bone marrow uptake for lanthanum compounds. The advantages of short-lived radionuclides are lower radiation dose to the patient and the ability to conduct real time function studies.

In addition, significantly advanced isotope production capability is required. Most present accelerators were not designed for the production of medical isotopes. What is needed are dedicated cyclotrons that utilize advanced technologies such as superconducting magnets or adaptations of linear accelerators for exclusive isotope production. Improved targetry incorporating high efficiency radiochemical procedures which are remotely controlled would greatly contribute to advancing this research area. Finally, computer controlled, fully automated radiopharmaceutical preparation and delivery systems are required for broad application in a clinical situation.

Recent developments in the BER nuclear medicine program have produced new radiopharmaceuticals labeled with short-lived radionuclides. In syntheses involving the most important positron emitting radionuclides (Oxygen-15, 2 minutes; Nitrogen-13, 10 minutes, Carbon-11, 20 minutes and Fluorine-18, 110 minutes), one cannot use standard techniques. Rather, innovative rapid organo- and biosynthetic techniques must be developed using the technologies of molecular biology, biochemistry, organic chemistry, hot atom chemistry and radiochemistry.

The new short-lived radionuclide labeled radiopharmaceuticals are proving to be useful in **studies of the metabolic functions** of the brain and heart. However, the major advances that have been made to date in quantitating physiology and pathophysiology in the human brain and heart cannot be consolidated or advanced without proceeding to the next generation of biomedical studies utilizing Positron Emission Tomography. There is an urgent need for whole-body PET's to conduct research toward improving our understanding of cardiovascular physiology in man and of metabolism and mechanical function. In addition, successful development of advanced tomographic systems will have immediate medical implications in evaluation of stroke patients and diagnosis of degenerative brain disorders such as Alzheimer's, Huntington's and Parkinson's disease.

In FY 1987, research and development will be maintained and devoted to identifying and optimizing techniques for attaching radionuclides to monoclonal antibodies. Monoclonal antibodies have the potential for early detection of cancer, for following the response of patients to treatment, and for general cancer therapy. A substantial research and development effort will be required to perfect and evaluate techniques for using labeled monoclonal antibodies. It is anticipated that by FY 1987 work on monoclonal antibodies for cancer therapy labeled with yttrium-90, fermium-255, and einsteinium-253 will have progressed to the point that one or more of these agents will have been identified as having sufficient potential for clinical trials. In addition, the monoclonal antibody work will be extended to labeling with radionuclides suitable for positron tomographic diagnostic imaging.

Instrumentation research conducted by interdisciplinary teams at the DOE laboratories provides a conduit for transferring advanced electronic and detector technologies developed at the DOE facilities to the medical community. A major emphasis at present is on the development of a next-generation positron emission tomograph (PET). Presently available commercial PET systems have a resolution in the range of 8-12 mm, with two experimental systems reaching a resolution in the 5-6 mm range. These PET systems are capable of providing an image of changes of metabolic activity, but lack sufficient resolution to give quantitative measure of the specific activity in small subregions of an organ. Progress in this field has been rapid and it is anticipated that development of a prototype PET system with spatial resolution in the 2-3 mm range is likely in FY 1987.

The use of **magnetic resonance imaging (MRI) spectroscopy** to detect carbon-13 and nitrogen-15 labeled metabolites within intact tissues and cells holds exceptional promise in providing new insight into the mechanisms responsible for metabolic regulation. Because of the great importance of heart disease, current research efforts are focused on the identification of the metabolic effects in the perfused heart model of several proposed therapeutic strategies for treatment of ischemic heart disease. Efforts will be concentrated on obtaining quantitative measurements of metabolic concentrations in the heart. Most of the current applications of NMR to studies of metabolism have avoided the issue of determining the concentrations of metabolites under observation by emphasizing relative changes in the signal intensities of the metabolites detected. It is clear that much more information could be obtained from the spectra by quantitation.

A cooperative project between Brookhaven National Laboratory and Stanford University utilizing synchrotron radiation to reduce the hazards of angiography will be continued.

	FY 1985	FY 1986	FY 1987 Request
3. Carbon Dioxide Research.........................	$ 13,072	$ 12,586	$ 13,580

The FY 1987 budget request for the Carbon Dioxide Research program is $13,580,000. This budget provides for: a few of the highest priority recommendations from the State-of-the-Art publications to be implemented; a very basic program of data collection and continuation of measurements and development of models; possibly one new crop (rice) will be added to the study of vegetation response to elevated atmospheric CO_2 levels; minimal monitoring of research activities of other trace gases (e.g., methane) may be possible; monitoring, but no direct participation in the International Geosphere Biosphere Program (IGBP); and, finally, a minimal core ocean program needed to couple the atmosphere, oceans and the biosphere.

The goal of the Carbon Dioxide Research program is to develop a sound, quantitative atmospheric carbon dioxide knowledge base to aid in energy policy decision making. This goal involves the following objectives: improve knowledge of the carbon cycle; improve estimates of future atmospheric carbon dioxide; improve understanding of the effects of atmospheric carbon dioxide on climate; improve understanding of the direct carbon dioxide effects on productivity of natural and agricultural systems; develop and verify methods for the first detection of climate change due to increasing atmospheric carbon dioxide; identify, define and quantify indirect effects; define possible options for mitigating long-term consequences of a higher CO_2 atmosphere.

Carbon dioxide is a small but important component of the earth's atmosphere. The global CO_2 content of the atmosphere has increased from about 315 parts per million (ppm) to 345 over the past 26 years and is presently increasing by about 1.5 ppm annually. The majority of the CO_2 increase is a direct result of man's fossil energy use.

Increasing amounts of CO_2 and other trace gases in the atmosphere could enhance the "greenhouse effect", which would result in warming of the lower atmosphere. This, in turn, could cause changes in patterns of precipitation, evaporation and wind circulation. In the last decade, physically-based, mathematical simulation models of the global atmosphere have tended to give added credence to these projections. More CO_2 will modify plant growth with the potential for increased crop productivity and changed composition of natural vegetation.

The effects of continuing CO_2 increases in the atmosphere are uncertain. The magnitude and rate of man's future use of fossil fuel further complicate the already uncertain picture. However, the scientific consensus is that global climate change involving temperature and precipitation will occur. The timing, magnitude, regionality and any subsequent benefits and/or costs are uncertain, and the extent of the uncertainty is not yet defined.

4. Program Direction	FY 1985	FY 1986	FY 1987 Request
Operating Expenses..............................	$ 3,475	$ 3,129	$ 3,600
Total FTE's......................................	53	53	53

The FY 1987 request for Biological and Environmental Research Program Direction is $3,600,000. These funds are required to provide for the personnel and other costs associated with continuation of 53 full-time equivalents.

This staff directs, manages, and supports a comprehensive multidisciplinary research effort designed to understand the long-term health and environmental effects associated with the development and use of fossil, nuclear and renewable energy technology options as well as the Department's nuclear weapons operations. In carrying out these responsibilities, the staff provides guidance and support for approximately 760 active research projects (reviewing and evaluating many more throughout the proposal selection process), develops long-range program plans based on their assessment of the scientific needs of the program and agency priorities, and conducts major reviews of BER sponsored programs at laboratories and universities. This requires a close liaison with other DOE programs, other Federal agencies and the scientific, academic and industrial communities. This staff also provides the administrative and program support services required to carry out the program.

The BER program has been reoriented toward a greater commitment to basic research requiring a wide range of scientific and technical expertise in all of the subprograms. This program direction request will provide the staffing resources to maintain the various professional scientific disciplines necessary to evaluate efforts carried out in the multiprogram laboratories, specialized biomedical and environmental facilities and over 125 universities, hospitals and other research institutions. The wide range of required expertise includes disciplines such as biochemistry, biophysics, molecular and cellular biology, genetics, toxicology, radiation biology, epidemiology, nuclear medicine, physiology, analytical chemistry, atmospheric sciences, ecology, oceanography and many others. There are also demands on staff for increased outreach efforts for Departmental commitments to Small Business Innovative Research and Historically Black Colleges, and for support of the Health and Environmental Research Advisory Committee (HERAC).

	FY 1985	FY 1986	FY 1987 Request
5. Facility Operations...........................	$ 9,866	$ 10,584	$ 12,000

Facility operations provide for the necessary capital equipment and general plant project needs to support the BER program and the Pacific Northwest Laboratory landlord responsibilities. The national laboratories and other onsite specialized laboratories supported by the BER program represent an impressive national resource of skilled investigators, advanced major scientific instrumentation and exceptional, often unique, research facilities. The ability to address the diversity of health and environmental research issues requires a continued commitment to maintaining their advanced instrumentation and facilities. Capital equipment ($8,500,000) and general plant projects ($3,500,000) are essential elements to facility operations.

Recent years of constrained budgets have resulted in a serious backlog of state-of-the-art equipment needs. Also, existing equipment at the laboratories is suffering from deterioration and obsolescence and is in urgent need of replacement. The capital equipment request for this program is essential for pursuing the health and environmental issues associated with energy technology considerations and to continue high quality research and advances in the development of nuclear medicine technology. Examples of capital equipment needed at laboratories and universities to support research include: scanning electron microscope, liquid chromatograph, liquid scintillation counter, spectrometer, amino acid analyzer, environmental chamber, infrared analyzer, animal caging, etc. Many of these items are interchangeable among various research efforts, and therefore, can serve numerous experiments over a period of time, making them very cost effective.

The capital equipment request also supports general purpose equipment needs at the Pacific Northwest Laboratory (PNL). General purpose equipment requirements at PNL fall into two broad capital support categories: (1) providing PNL support services and tools of a nonprogrammatic nature such as Safeguards, Safety, Security, etc; (2) PNL provides various support services such as Environmental Surveillance, Personnel Dosimetry, Photography, etc. for the entire Hanford complex.

Construction funds of $3,500,000 are requested in support of the program's general plant project needs and the Pacific Northwest Laboratory landlord responsibility. General plant projects are necessary to accommodate continuing requirements to maintain satisfactory and economical operating conditions, to meet regulatory requirements and to provide for new program developments. Process development and changes in technical program requirements frequently result in the need for alterations or new construction items not previously anticipated. In addition to satisfying programmatic requirements, general plant projects provide the alterations and additions to existing facilities needed to: 1) satisfy radiation protection, health and safety, environmental protection, and energy conservation requirements; 2) improve operating efficiency; and 3) provide optimum utilization of existing facilities.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
ENVIRONMENTAL R & D
BIOLOGICAL AND ENVIRONMENTAL RESEARCH
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: General plant projects

2. Project No.: 87-R-120

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3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 2nd Qtr. FY 1987

4. Date construction ends: 2nd Qtr. FY 1989

5. Previous cost estimate: None
Date:

6. Current cost estimate: $3,500
Date: 12/85

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7. Financial Schedule:

Fiscal Year	Obligations	Costs FY 1985	FY 1986	FY 1987	After FY 1987
Prior Year Projects	XXXXXXXX	$ 4,034	$ 1,848	$ 726	$ 205
FY 1985 Projects	$ 2,725	256	365	1,099	1,005
FY 1986 Projects	3,127	0	364	1,300	1,463
FY 1987 Projects	3,500	0	0	875	2,625

8. Brief Physical Description of Project

This estimate is for minor new construction and other capital alterations to land, buildings, and utilities systems. The estimate also includes the cost of installed equipment which is an integral part of the general plant subprojects.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: General plant projects

2. Project No.: 87-R-120

8. Brief Physical Description of Project (continued)

Although it is difficult to detail this type project in advance, all of the subprojects identified below are under consideration. In general, the estimated costs for each of the subprojects are preliminary in nature, with a project limitation of $1,200,000, and primarily indicative of the size of the project. The continuing review of our requirements will result in some of the projects being changed in scope; it will also result in other projects being added to the list with the necessary postponements of some now listed, all depending on conditions or situations not apparent at this time. Since needs and priorities may change, other projects may be substituted for the examples listed below, and some of these may be located on non-Government owned property. These general plant projects will provide facilities for conducting critical research programs, contribute to greater efficiency, eliminate health and safety hazards, and will reduce maintenance and operational costs.

The estimate is based on requirements by office as follows:

Summary by Office	
Albuquerque Operations Office	$ 1,500
Oak Ridge Operations Office	500
Richland Operations Office	1,000
San Francisco Operations Office	500
Total	$ 3,500

9. Purpose, Justification of Need for, and Scope of Project

The following is a tentative tabulation of the major projects to be performed at the various laboratories under the operations office listed.

Albuquerque Operations Office

Inhalation Toxicology Research Institute Controlled material storage facility, primate housing facility modifications, chilled water system, and other emergency repairs.	$ 1,000
Los Alamos National Laboratory Health research laboratory addition and other emergency repairs.	500

1. Title and location of project: General plant projects 2. Project No.: 87-R-120

9. Purpose, Justification of Need for, and Scope of Project (continued)

Oak Ridge Operations Office
Oak Ridge Associated Universities.. 500
Low humidity chromatography room, replacement of roof at Scarboro facility, and other emergency repairs.

Richland Operations Office
Pacific Northwest Laboratory.. 1,000
Miscellaneous capital work orders, e.g., laboratory additions, improvements, and modifications.

San Francisco Operations Office
Lawrence Livermore National Laboratory.. 500
Upgrade air handling and toxic exposure animal facility, refurbish water circulation system for marine biology, and other emergency repairs.

10. Details of Cost Estimate

Based on preliminary conceptual design.

11. Method of Performance

Design will be by negotiated architect-engineer contracts. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bids.

Magnetic Fusion

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
PROGRAM OVERVIEW

Magnetic Fusion Energy

The goal of the National Energy Policy Plan is to foster an adequate supply of energy at reasonable costs. The Magnetic Fusion Energy program is an element of this program. The goal of this program is to establish the scientific and technological base required for fusion energy. The program is making good technical progress toward this goal. The long term need and desirability for fusion energy continues to be strong. However, the program plan and the program budgets have been adjusted to reflect improvements in our near term energy supply as well as the need for austerity in federal spending. In this situation, international collaboration is being used as a key resource to support achievement of the program goal in a timely fashion.

The development of magnetic fusion could lead to economic energy sources that possess a secure fuel reserve, as well as acceptable environmental and safety features. The fuel, deuterium and tritium from lithium, is readily available and its supply is essentially unlimited. Potential end use applications are electricity generation, the production of synthetic fuels, nuclear fuels, and high grade heat for industrial applications.

Nearer term benefits of fusion development include an increase in the understanding of plasma physics and related scientific fields. Fusion also attracts and trains outstanding scientists and engineers. Fusion-related science combines plasma physics, atomic physics, nuclear physics, surface and solid state physics, and advanced computational techniques. Fusion-related technology involves superconducting systems, large magnetic systems, high power radio frequency heating systems, tritium systems, high heat flux energy recovery systems, advanced materials development, nuclear technology, real time computer control, sophisticated instrumentation, unique vacuum systems, and particle beam heating systems. The technology developed in support of fusion research has many applications in science and industry.

Over the last decade, a significant investment in equipment and facilities has been made and a core group of skilled scientists and engineers has been trained. With this investment in place, excellent and sustained progress is being made. We have reached a point now where there is general agreement that the remaining technical problems can be solved. With a sustained effort the program goal can be achieved by the time the need for new energy sources becomes acute.

The FY 1987 budget request has been developed to take advantage of the technical position that has already been established in fusion research. It will allow a continuation of cost effective progress toward the development of fusion power as a future energy option and positions the program to support the President's Geneva initiative on international cooperation in this area.

The request of $333 million represents the level of resources required to sustain an effective program. To maintain progress at this level of funding, the program has been narrowed to pursue only toroidal confinement systems. In addition, we have identified the highest priority tasks, improved the cost effectiveness of facility operations, and increased the use of international collaboration. The program has been focused to address four key technical issues; namely, the development of magnetic confinement systems, understanding of scientific principles of a burning plasma, the development of materials for fusion applications, and the development of fusion nuclear technology.

Resolution of the first issue requires the scientific understanding of magnetic confinement systems in order to develop a desirable fusion reactor system. This budget supports the minimum set of experiments to obtain this understanding. There are two principal approaches to confining a plasma magnetically: the toroidal and linear concepts. In the past, the U.S. has pursued both approaches. Beginning in 1987, such breadth is no longer feasible. The U.S. program will focus on development of only the toroidal confinement concept. The tokamak is the most advanced in terms of performance within the toroidal category. However, by studying related toroidal configurations, a better understanding of toroidal confinement will be achieved than if only the tokamak were studied. This strategy will most readily lead to improvement in tokamaks and the development of superior magnetic geometries for practical application in the future. Consequently, this budget request covers work on the tokamak, reversed field pinch, stellarator, and compact toroid variations of toroidal magnetic confinement.

The second technical issue requires the development of a facility to investigate the properties of burning plasmas. A fusion plasma burns when the heat released within the plasma by the fusion reaction is sufficient to maintain the plasma temperature in the face of heat loss from the system. The requirements for ignition should become clear from experiments planned for the Tokamak Fusion Test Reactor at Princeton, during the latter part of the 1980's. Following this achievement, at least one ignited and burning plasma must be produced and studied to complete the scientific data base. This budget supports the necessary preparatory design studies for such a facility.

The third technical issue--materials for fusion systems--affects the ultimate economic and environmental acceptability of a fusion system. Development of the desired materials must be undertaken now because of the long lead time for the required research. This budget supports a level of activity in this area necessary to establish effective international collaboration.

The fourth issue--nuclear technology for fusion systems--includes developing a fusion "blanket" that must convert the energy released by a fusion reaction into useful energy, as well as creating part of the fuel for the reactor. This budget request provides for the most essential preparatory research which will be needed to develop an acceptable blanket in future years.

The FY 1987 budget request of $333 million will maintain some effort in each of the four key technical issues. At this level the FY 1986 initiatives needed to implement the revised program plan continue while other program elements are delayed or deferred. In the Applied Plasma Physics subprogram, a core base of research is maintained. The two major device fabrication projects that were initiated in FY 1986, the reversed field pinch experiment and a compact toroid experiment will be continued. In the Confinement Systems subprogram, TFTR will attempt to reach break-even conditions in deuterium plasmas and preparations will continue for limited D-T operation in 1989. As part of the US/Japan cooperation program, Doublet III will explore beta limits with shaped plasmas. Collaboration abroad, especially on European tokamaks, will continue. Collaboration on these tokamaks allows the U.S. to gain valuable information while avoiding duplication. Studies to support expanded collaboration with the Soviets will begin. In the tandem mirror area, the TMX-U and TARA experimental programs will be completed. The MFTF-B will be mothballed. In the Development and Technology subprogram, design studies on an experiment to study the physics of ignition will be continued. Facility design and development of ion cyclotron radio frequency heating components will be emphasized. The six coil test in the

International Fusion Superconducting Magnet Test Facility at Oak Ridge National Laboratory will be completed. The ongoing materials program will be maintained at an adequate level to support international collaboration in this area, and small scale laboratory tests of critical blanket issues will be carried out.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
MAGNETIC FUSION ENERGY
ENERGY SUPPLY RESEARCH AND DEVELOPMENT - OPERATING EXPENSES
ENERGY SUPPLY RESEARCH AND DEVELOPMENT - PLANT AND CAPITAL EQUIPMENT

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
Magnetic Fusion Energy					
Applied plasma physics					
Operating Expenses.......	$ 78,937	$ 69,692	$ 69,692	$ 70,700	$+ 1,008
Capital Equipment........	3,170	5,619	5,619	4,500	- 1,119
Subtotal................	82,107	75,311	75,311	75,200	- 111
Confinement systems					
Operating Expenses.......	206,395	188,650	188,650	177,500	-11,150
Capital Equipment........	15,400	14,529	14,529	7,100	- 7,429
Subtotal................	221,795	203,179	203,179	184,600	-18,579
Development and technology					
Operating Expenses.......	67,900	57,059	57,059	50,510	- 6,549
Capital Equipment........	5,100	4,330	4,330	1,890	- 2,440
Subtotal................	73,000	61,389	61,389	52,400	- 8,989
Planning and projects					
Operating Expenses.......	12,201	5,528	5,528	4,780	- 748
Capital Equipment........	3,800	3,801	3,801	3,820	+ 19
Construction.............	32,500	12,653	12,653	8,200	- 4,453
Subtotal................	48,501	21,982	21,982	16,800	- 5,182
Program Direction					
Operating Expenses.......	4,150	3,608	3,608	4,000	+ 392
Subtotal................	4,150	3,608	3,608	4,000	+ 392
Total					
Operating Expenses.......	369,583	324,537	324,537	307,490	-17,047
Capital Equipment........	27,470	28,279	28,279	17,310	-10,969
Construction.............	32,500	12,653	12,653	8,200	- 4,453
Magnetic Fusion Energy.....	$429,553 a/ b/	$365,469 b/ c/	$365,469	$333,000 b/	$-32,469
Staffing Total FTE's.......	66	62	62	62	--

Authorization: Section 209, P. L. 95-91

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a/ FY 1985 total does not include $3,671,000 transferred to the SBIR program. The FY 1985 total reflects a reduction of $2,940,000 for ADP general reduction.

b/ Total reflects a reduction of $7,194,000 in FY 1985, $10,000,000 in FY 1986, and $10,811,000 in FY 1987 for management initiative savings.

c/ FY 1986 reflects the following comparability changes: $673,000 from Development and Technology to Planning and Projects for inventories, $15,395,000 from Planning and Projects to Confinement Systems for MFTF-B, and $3,989,000 from Applied Plasma Physics to Planning and Projects for Small Business Innovative Research. This aligns the FY 1986 funds consistent with the budget allocation in FY 1987. Total reduced by $14,358,000 in accordance with P.L. 99-177, the Balanced Budget and Emergency Deficit Control Act of 1985 (Gramm-Rudman-Hollings).

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer.	General Reduction	Management Initiatives	Pay Cost Restoration	FTE General Reduction	Gramm-Rudman-Hollings	ES&H Transfer/ Reprogramming	Subtotal	Comparability Adjustments	Total
Magnetic Fusion Energy										
Applied Plasma Physics										
Operating Expenses	$ 78,100	$ -1,500	$ -25			$ -2,894		$ 73,681	$ -3,989	$ 69,692
Capital Equipment	6,400	—	-560			-221		5,619	—	5,619
Subtotal	84,500	-1,500	-585			-3,115		79,300	-3,989	75,311
Confinement Systems										
Operating Expenses	184,900	-4,000	-840			-6,805		173,255	15,395	188,650
Capital Equipment	15,100	—	—			-571		14,529	—	14,529
Subtotal	200,000	-4,000	-840			-7,376		187,784	15,395	203,179
Development and Technology										
Operating Expenses	62,500	-2,500	—			-2,268		57,732	-673	57,059
Capital Equipment	5,000	—	-500			-170		4,330	—	4,330
Subtotal	67,500	-2,500	-500			-2,438		62,062	-673	61,389
Planning and Projects										
Operating Expenses	16,900					-639		16,261	-10,733	5,528
Capital Equipment	3,950					-149		3,801	—	3,801
Construction	13,150					-497		12,653	—	12,653
Subtotal	34,000					-1,285		32,715	-10,733	21,982
Program Direction										
Operating Expenses	4,000	-181			-67	-144		3,608		3,608
Subtotal, Magnetic Fusion Energy......................	390,000	-8,181	-1,925		-67	-14,358		365,469	—	365,469
General Reduction:										
Operating Expenses	-8,181	8,181								
Capital Equipment	—	—								
Construction	-8,181	8,181								
Total, General Reductions										
Management Initiatives:										
Operating Expenses	-865		865							
Capital Equipment	-1,060		1,060							
Construction	—		—							
Total, Management Initiatives	-1,925		1,925							
Pay Restoration										

	FY 1986 Confer. (1)	General Reduction (2)	Management Initiatives (3)	Pay Cost Restoration (4)	General Reduction (5)	Rudman-Hollings (6)	Transfer/ Reprogramming (7)	Subtotal (8)	Comparability Adjustments (9)	Total (10)
Use of Prior Year Balances (Magnetic Fusion)										
Operating Expenses										
Capital Equipment										
Construction										
Total, Prior Year Bal. (Magnetic Fusion)										
Use of Prior Year Balances (Other Energy Supply)										
Operating Expenses										
Capital Equipment										
Construction										
Total, Prior Year Bal. (Other Energy Supply)										
Total, Magnetic Fusion Energy.	$379,894				-67	$-14,358		$365,469		$365,469
Operating Expenses	337,354				-67	-12,750		324,537		324,537
Capital Equipment	29,390					-1,111		28,279		28,279
Construction	13,150					-497		12,653		12,653

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
MAGNETIC FUSION ENERGY
(In thousands of dollars)

1986 Appropriation enacted	$379,827
1986 Gramm-Rudman reduction	-14,358
1987 adjusted	365,469
Program increases and decreases:	
Applied Plasma Physics	
o This decrease reflects cutbacks in selected lower priority areas primarily in theory and small-scale experimental research support	- 111
Confinement Systems	
o This decrease is primarily associated with focusing the program on the toroidal confinement configuration and completing efforts on the mirror program	-18,579
Development and Technology	
o This decrease is primarily associated with an effort to focus on the most critical technology issues	- 8,989
Planning and Projects	
o A significant portion of this reduction is associated with the completion of MFTF-B construction	- 5,182
Program Direction	
o Provide support for 62 FTE's	+ 392
1987 budget request	$333,000

	FY 1985	FY 1986	FY 1987 Request
I. Applied Plasma Physics........................	$82,107	$75,311	$75,200
A. Operating Expenses........................	78,937	69,692	70,700

The Applied Plasma Physics subprogram develops fusion knowledge through theoretical studies and small experiments that complement the larger Confinement Systems experiments and help to assure that fusion development advances steadily and cost effectively. Working closely with the Confinement Systems subprogram, Applied Plasma Physics plays a key role in the technical issue of developing magnetic confinement systems. Applied Plasma Physics also helps to establish the basis for understanding burning plasmas through its theoretical and diagnostics development activities. It contributes to the task of developing fusion materials led by the Development and Technology subprogram through its theoretical and experimental research on plasma-wall interaction. The Applied Plasma Physics subprogram is people and idea intensive. As a result, international activities in this area concentrate on workshops for discussion of ideas and longer term exchange of individual scientists for collaborative theoretical or experimental research. Through international steering committees and individual meetings, subprogram representatives seek to coordinate research activities with those of other countries to integrate areas of common interest.

Specifically, this subprogram is responsible for fusion theory, for experimental plasma research on small devices, for fusion-related atomic physics, and for development of new diagnostic techniques required to determine plasma behavior. The subprogram is also responsible for developing and testing alternate fusion confinement concepts that are not yet advanced to the point of Confinement Systems tests. Through its support of university research, this subprogram trains a large percentage of the scientists employed in all areas of the fusion program. It also manages the Magnetic Fusion Energy Computer Network that provides all of the large scale computing used by the fusion program for experimental data analysis, theoretical modeling, experimental design, and system studies.

In FY 1987, Applied Plasma Physics will continue several important tasks begun in FY 1986. Fabrication of upgraded reversed field pinch and compact toroid experiments will be continued to allow study of plasmas closer to fusion conditions in these attractive subclasses of the toroidal confinement concept. Tests of several promising theoretical ideas for tokamak improvements will be continued in small-scale experiments. More realistic models of fusion plasma behavior will be developed and tested, aided by the installation of the Cray 2 computer, the first of this new generation, at the National Magnetic Fusion Computer Center.

	FY 1985	FY 1986	FY 1987 Request
(1) Advanced Fusion Concepts............	22,465	19,558	21,900

The Advanced Fusion Concepts category supports operation of modest scale experimental devices that investigate improvements in fusion confinement. Crucial physics tests of innovative plasma-magnetic field configurations are conducted to advance and broaden the range of understanding of plasma behavior. This level of testing extends from exploratory examination of novel approaches to intensive study of more mature innovative concepts. Research is conducted in national laboratories, industries and several universities. This activity contributes to the resolution of one of the key program technical issues, the development of magnetic systems, through the exploration of non-tokamak toroidal configurations with potentially attractive features. The majority of this effort is devoted to two toroidal confinement approaches, the reversed field pinch (RFP) and the compact toroid. Fundamentally new plasma behavior that could improve the attractiveness of fusion as an energy source has been discovered in this research. These discoveries have made possible significant progress in these approaches and may be applicable to the tokamak as well. The discoveries resulted not only from experiments in the U.S., but also from related work in Italy, Japan, and the Soviet Union that has been closely coupled to our own efforts.

Therefore, the requested budget will be used to support an important shift in emphasis that was initiated in fiscal year 1986. Two operating programs, the Reversed Field Pinch (RFP) and one version of the compact toroid called the field-reversed configuration (FRC), have met the previously established objectives for their development, and experiments are now being fabricated for the next crucial tests of confinement issues. The increment in funding is to continue this fabrication.

	FY 1985	FY 1986	FY 1987 Request
Research Operations................	$21,501	$14,413	$12,455

The shift in emphasis in the Advanced Fusion Concepts category is indicated in the budget requests for the past two years. The decrement in Research Operations in fiscal year 1986 was needed to shift funds into the Major Device Fabrication (MDF) subcategory. Research operations in the RFP and compact toroid areas were reduced as a result. During this fiscal year, a further funding shift is needed to meet the increased requirements in the MDF subcategory. A spheromak at the University of Maryland will begin experimental operation under this funding. This device has a 25 kilogauss magnetic field strength, the highest of any spheromak. This should allow testing of plasma heating and energy confinement during FY 1987. The University of Wisconsin RFP device began operations in 1986 and will continue to investigate crucial issues of physics and stability in a unique low cost experiment. While it does not extend plasma conditions beyond present levels achievable in other RFP devices, it will be used to study improvements in the RFP geometry, and it complements the MDF experiment in this concept. Several university experimental efforts are continuing to investigate crucial issues with unique, low cost facilities.

	FY 1985	FY 1986	FY 1987 Request
Major Device Fabrication...........	0	4,495	9,025

Two projects were initiated in the fiscal year 1986 budget. The first project is an RFP device whose performance objectives included a plasma current capability of 4 million amperes. This device is predicted to increase the confinement parameter by three orders of magnitude beyond existing devices and reach ion temperatures of 4 keV. It is to be completed in 1990, replacing the ZT-40 RFP device at LANL. The second project, an FRC device, whose objectives include the investigation of crucial physics issues of transport and stabilization in a small, high beta plasma. It will be completed in 1989, replacing the TRX-2 device at Spectra Technology.

These two projects will enable the fusion program to investigate the confinement physics of compact, high beta toroidal configurations.

	FY 1985	FY 1986	FY 1987 Request
Supporting Studies................	$ 964	$ 650	$ 420

Exploratory experimental tests at modest levels of funding are carried out on two confinement approaches, the heliac and the dense Z-pinch. These supporting studies are characterized by either high beta or high power density concepts that may have the potential for very attractive reactor embodiments.

(2) Fusion Theory.......................	22,644	19,046	17,500

The fusion plasma theory category is responsible for the formulation and development of theories and models that explain the behavior of plasmas in fusion devices. A budget of $17,500,000 is requested to support these activities in FY 1987. In FY 1987, continued emphasis will be placed on theoretical studies to develop improvements in design and performance of toroidal concepts. Both analytical and computer models will be developed and applied. In addition, support will be provided for the modeling and interpretation of transport, confinement and auxiliary heating in the Advanced Toroidal Facility, a medium-sized stellarator experiment at ORNL, described in the Confinement Systems section. Further development of multi-dimensional simulation codes will also be supported. Models of burning plasmas will be refined in support of ignition and the burning plasma issue.

Slightly increased funding for toroidal theory will be used to strengthen the efforts in developing transport models and to study the effects of electric fields on confinement. Theoretical support of major toroidal experiments will be provided by task groups consisting of laboratory and university theorists. Further consolidation in the activities of national laboratory groups and large universities will be undertaken.

Mirror theory support will be decreased. Some theorists formerly associated with mirror theory will be redirected to work on toroidal or generic theories to support the overall program.

Funding for alternate concept theory will be decreased to reflect the decrease in research operations. Existing theories will be applied to understand the next generation of higher current, higher temperature alternate concept devices, as well as to develop and exploit uniform theoretical models which are applicable to both alternate concepts and principal concepts, such as tokamaks and stellarators.

Generic theory support will also be decreased. The requested funds will be used to support development of methods to treat non-linear problems and plasma turbulence. The Institute for Fusion Studies will be maintained at previous levels while support for atomic theory will increase slightly. The funds will cover developments in the theory of atomic processes (i.e., collisions and ionization) in plasmas, with emphasis on high temperature conditions.

	FY 1985	FY 1986	FY 1987 Request
(3) Experimental Plasma Research.........	$16,024	$14,866	$13,215

The experimental plasma research category contributes to the understanding of fusion plasma properties through basic research and develops innovative ideas for modifications to the tokamak concept through small scale research. The activities supported are diverse, ranging from research in atomic and plasma physics to testing of specific plasma configurations and diagnostic techniques. The experimental research activities are coordinated with the major plasma confinement tests carried out in the Confinement Systems subprogram. Research is supported primarily at universities, with a few activities carried out at national laboratories and industrial sites.

Of the requested $13,215,000 in operating funds, $8,875,000 will support plasma physics research. About $3,700,000 of these funds will be directed to new tests of ideas being advanced for tokamak improvement. These experiments will test modified plasma configurations and new techniques for driving the current required in the tokamak plasma. These innovation experiments were initiated in FY 1986 with emphasis on ideas that can be viably tested on a small scale and that extrapolate to definite performance improvements. The remaining plasma research funds ($5,515,000) support basic research (for example, on particle and heat loss mechanisms) on innovative ideas which can be pursued in existing facilities (for example, electron cyclotron heating for prevention of plasma disruptions on the Texas Experimental Tokamak).

About $3,140,000 of these funds support development of new or improved diagnostic techniques. Improved diagnostics are needed for spatial and temporal resolution of plasma temperature, density, and internal magnetic and electric fields. Such improved diagnostics are developed primarily through atomic beam and laser systems. New diagnostics are needed to measure properties of the nuclear reactions and resulting heating in burning plasmas. These burning plasma diagnostics may detect nuclear products outside the plasma (neutrons and gamma rays) and must also measure properties of the fast alpha particles within the plasma. In all cases these funds support only conceptual development and first tests of diagnostic systems. The diagnostic system tests may utilize small laboratory plasmas, the TEXT user facility, or, if required, major plasma devices within the Confinement Systems program.

About $1,200,000 of these funds are for understanding basic atomic physics processes that control plasma behavior and that can be exploited for plasma diagnostic purposes. This research uses plasma devices such as the TEXT tokamak, and other facilities such as low energy ion beams, accelerators, and laser driven light sources. In FY 1987 this effort will be directed at improved understanding of collisions between electrons and impurity ions. Detailed experiments on electron-ion collisions have just recently become possible and require revisions of previously used calculations.

	FY 1985	FY 1986	FY 1987 Request
(4) National MFE Computer Network........	$17,804	$16,222	$18,085

The National Magnetic Fusion Energy Computer Network provides large- and medium-scale scientific computing facilities for the entire magnetic fusion energy program. The center and the network have continued to play a crucial role in the development of the fusion program in the United States. The network provides access for the entire fusion community, both theoretical and experimental, to first-class computing, data analysis and modeling facilities. The network and the center have served as a model for many National Science Foundation projects to provide supercomputer access for university researchers.

The National Magnetic Fusion Energy Computer Network consists of the Magnetic Fusion Energy Computer Center (MFECC) located at Lawrence Livermore National Laboratory in Livermore, California, and a number of smaller scientific computers at other locations connected by a communications network which includes satellite links and leased land lines. This network provides the flexibility to match the communications power at a site to the load at that site, thus avoiding bottlenecks and unnecessary costs. To service the computing needs of the magnetic fusion program the MFECC includes a Cray 1, a Cray 1S, and a Cray 2. The Cray 2 computer is over four times as powerful as the Cray 1S and has significantly ameliorated the capacity problems at the MFECC. In addition, the Cray 2 has an extremely large memory which makes feasible more realistic three-dimensional computations than possible on earlier machines. Indeed, within the first three months after installation of the Cray 2, problems had been solved which were not possible on earlier computers.

This budget requests an increase of $1,863,000 over the FY 1986 budget. These funds will be used to restore the User Service Centers to a level at which they can effectively support their local users, to cover cost of living increases at the NMFECC and to initiate a lease to ownership of additional disk storage which is required to support the mature usage of the Cray 2 computer.

B. Capital Equipment........................	3,170	5,619	4,500

An equipment budget of $3,000,000 is requested in support of the RFP MDF project. The funds will be used in partial payment for acquisition of the power supply system including a motor-generator flywheel, power converters and space preparation.

The research operations subcategory of the Advanced Fusion Concepts budget includes $700,000 for general laboratory and data acquisition equipment for experiments at the national laboratories.

$100,000 of capital equipment funds are to be used in the new tokamak improvement tests. $485,000 is to be used for general research equipment, primarily in diagnostic development ($250,000) and at TEXT ($100,000).

The sum of $215,000 is requested to procure replacement parts and some of the equipment required to maintain the network and the User Service Centers.

	FY 1985	FY 1986	FY 1987 Request
II. Confinement Systems...........................	$221,795	$203,179	$184,600
A. Operating Expenses........................	206,395	188,650	177,500

The Confinement Systems subprogram supports the Magnetic Fusion program's goal by working on two of the four key technical issues--the development of magnetic confinement systems, and the exploration of the scientific principles governing the behavior of burning plasma. The Confinement Systems subprogram contributes to the resolution of the former issue by conducting experiments to develop a scientific understanding of high temperature, collisionless plasmas. It contributes to the latter issue by operating the state-of-the-art research devices needed to identify the conditions required for ignition and to prepare for a burning plasma experiment.

The tokamak, the stellarator, and the tandem mirror magnetic confinement concepts have progressed to the stage of medium to high temperature tests of plasma physics principles. Of these, the tokamak and stellarator are closely related toroidal systems. The tandem mirror is a linear system. Although the confinement physics of these two classes of confinement systems is different, many of the basic plasma phenomena have common elements. In addition, many theoretical and experimental techniques and much technology are applicable to both. Both toroidal and linear magnetic confinement systems are making good technical progress. However, to accommodate present fiscal constraints, further research on tandem mirrors is being deferred in order to maintain a strong, focused toroidal program.

The Confinement Systems subprogram will resolve the first key technical issue by investigating the physics of toroidal systems in order to gain the predictive scientific understanding that will make the choice of an attractive confinement configuration possible. Since the tokamak concept has advanced to the point where it can serve as the vehicle for the exploration of the scientific principles governing the behavior of a burning plasma. The study of high temperature tokamak plasmas provides the scientific basis for resolution of the second key technical issues as well.

	FY 1985	FY 1986	FY 1987 Request
(1) Toroidal Confinement Systems.........	151,410	141,502	151,800

The Toroidal Confinement Systems' subelement has the responsibility for research on toroidal configurations operating with fusion relevant plasma conditions. The budget request of $151,800,000 is $10,298,000 above the FY 1986 level and includes an increased effort on TFTR and the Advanced Toroidal program. The research program for toroidal configurations is planned to resolve a discrete set of basic scientific issues. These issues are investigated through experiments on several devices. Each device is designed to address one or more of these basic scientific issues.

Historically, the tokamak was the first magnetic configuration device to demonstrate good confinement of hot, dense plasmas in a moderate sized device. The demonstration was significant enough to indicate that the tokamak had the potential to become a practical fusion reactor. The progress in the last 11 years has supported this initial indication. Because of this high level of performance in confining hot, dense plasmas, the tokamak has become the first choice of the international fusion community for studying the scientific issues associated with high temperature plasmas. It is also the leading candidate for a reactor confinement concept. In FY 1986, tokamaks in the U.S., Japan, and the European communities will all be operating with plasma confinement very near to reactor requirements. Furthermore, in FY 1986 the auxiliary heating of TFTR will be advanced to the point where equivalent energy breakeven experiments in a deuterium plasma will begin. This breakeven condition occurs when the calculated fusion power output from a D-T plasma equals the heating power input. This is expected to be achieved in 1987 on the TFTR experiment.

The underlying physics in all toroidal configurations is similar enough that advances made on one configuration can contribute to the improvement of another. The stellarator, in particular, has made outstanding progress in Japan and West Germany partly because they have been able to use the physics results from the tokamak. The Reversed Field Pinch (RFP), discussed in the Applied Plasma Physics subprogram, has evolved rapidly because of the infusion of tokamak-developed diagnostics, technology and theory. The spheromak (a close relative of the tokamak which is also discussed in the Applied Plasma Physics subprogram), was discovered by scientists associated with the tokamak program and is now under active experimental study. Each of these research efforts contributes to the understanding required for the development of a practical fusion reactor.

The potential of the tokamak concept continues to be enhanced by proposed modifications which would provide substantial performance gains. Tokamak improvements are being investigated on the Princeton Beta Experiment (PBX) and by proposed advanced configurations under study at the Oak Ridge National Laboratory (ORNL), GA Technologies (GA), and the Massachusetts Institute of Technology (MIT).

The search for improving the toroidal configuration by the addition of helical fields, as in the stellarator, is supported by the Advanced Toroidal Facility (ATF) at Oak Ridge National Laboratory and by a program of international collaboration. The U.S., Japan, West Germany, and Spain collaborate very closely on medium sized stellarator experiments, thereby, making it possible to explore a significant portion of the large range of physics parameters that the stellarator can produce.

Scientific issues associated with a burning plasma are being addressed by the coordinated programs of confinement experiments in several countries. The key U.S. experiment is TFTR, which is providing the initial size and plasma parameter scaling information that is needed for the design of a burning plasma experiment. Subsequent information on auxiliary heating techniques and impurity control that will be valuable in the design of a burning plasma experiment is being obtained from the Joint European Torus (JET) and the Japanese JT-60 tokamak through a program of international collaboration on large tokamaks. In FY 1987, under a U.S./Japan agreement, the D-III-D experiment will begin substantive experiments in a D-shaped tokamak plasma to investigate stable operation with better magnetic field utilization (beta). This is a key issue in the size and cost of a burning plasma experiment. Also of interest for burning plasma experiments is the physics of ash removal and impurity control which is being studied through international collaborations on the TEXTOR (West Germany), ASDEX-Upgrade (West Germany), and TORE-SUPRA (France) tokamaks.

The following is a summary of the budget request for the four Toroidal Confinement Systems operating categories:

	FY 1985	FY 1986	FY 1987 Request
Tokamak Fusion Test Reactor........	$74,256	$67,974	$78,400

This budget will support the operation of TFTR, including the preparation for using ion cyclotron radio frequency heating to broaden the range of plasma parameters the machine can produce. It will continue preparation for FY 1989 tritium operations. In FY 1987 TFTR will have all of its subsystems operating at full capabilities, including the reliable operation of the long pulse neutral beam ion sources. The near term objectives of the TFTR program are to study the basic properties of high temperature, high density hydrogen and deuterium plasmas. In FY 1987, TFTR is expected to achieve plasma breakeven conditions, the condition under which a D-T plasma would generate power equal to the auxiliary input power. Understanding the fundamental mechanisms governing the behavior of plasmas at breakeven conditions (high temperatures and high densities) will be of vital importance in designing a successful burning plasma experiment or a future toroidal device. In FY 1987 and FY 1988, TFTR, in conjunction with the other large tokamak experiments in the world, will provide a valuable opportunity to probe the physics of well confined, high temperature plasmas. Following the successful operation at the breakeven level through FY 1988, TFTR is scheduled to perform deuterium-tritium experiments in FY 1989. In these experiments, TFTR is expected to make possible the first investigations of the effects of alpha particles on toroidal plasma confinement and stability.

At MIT, following the completion of experiments on the Alcator C device, a team of physicists will collaborate on the TFTR experiment. In FY 1987, TFTR will be producing copious amounts of experimental data, and the additional scientists from MIT will expedite the analysis of this data and enhance the efficiency of the TFTR program.

	FY 1985	FY 1986	FY 1987 Request
Base Toroidal Program.............	49,690	46,885	38,700

The base toroidal program provides support for experimental research and operation of the conventional tokamak confinement experiments for the development of improved operational tools and techniques. This includes the Doublet III-D and support of several collaborative efforts on foreign experimental machines. In FY 1987 at GA Technologies, Inc., this budget will support the operation of D-III-D to extend the experimental operating parameters of this facility. The major objective will be to explore the limits of high beta operation. Limited to hydrogen operation, at the high energy densities planned, Doublet III-D will produce fusion relevant plasma parameters to provide information on the physics of burning plasmas. The physics effort on D-III-D will be strengthened in FY 1987 by collaboration with a team of physicists from the LLNL following the completion of the TMX Upgrade experiments.

The D-III-D facility is also an important part of the U.S.-Japan international collaboration for research on fusion energy development. A collaboration agreement between the Japan Atomic Energy Research Institute (JAERI) and the Department of Energy (DOE) to conduct a joint research program on D-III-D will continue through FY 1988. Japanese scientists will participate directly in the Doublet III-D research program.

The FY 1987 plans for the Base Toroidal Program reflect a growing commitment to international collaboration, especially in the areas of plasma fueling, particle control, rf heating, and steady-state operation in toroidal configurations. The European and Japanese programs have tokamaks that are either operational or are in the process of being installed which have long pulse heating and plasma control systems that make them attractive for the investigations of these issues. Design, operation, and understanding of either a short pulse ignited plasma or a long pulse experimental test reactor will benefit from an increased understanding of impurity control and particle handling issues. These devices include TEXTOR and ASDEX-Upgrade in the Federal Republic of Germany, TORE SUPRA in France, and JET in England. Scientists from PPPL, MIT, ORNL, GA, Sandia and University of California, Los Angeles (UCLA) will participate in these international activities.

	FY 1985	FY 1986	FY 1987 Request
Advanced Toroidal Program..........	$15,239	$12,148	$27,161

The Advanced Toroidal Program supports experiments designed to study improvements to the conventional toroidal configuration. This includes the first full year of operation of the Advanced Toroidal Facility and the Princeton Beta Experiment. The emphasis of the Advanced Toroidal Facility (ATF) at Oak Ridge National Laboratory will be on understanding the physics of toroidal systems that use external helical windings (stellarators) rather than a current flowing in the plasma to create the confining magnetic field. ATF is designed to create a wide range of magnetic confinement geometries which are complementary to stellarator experiments in Germany and Japan. The main objective is to determine the maximum beta that can be obtained. Demonstrating that a high beta stellarator geometry exists would be significant because the stellarator is intrinsically a steady state toroidal fusion configuration.

At PPPL, this budget will support the initial operation of the Princeton Beta Experiment Upgrade (PBX-U). The PBX has demonstrated the highest beta achieved yet in a tokamak using a shaped plasma configuration. An upgrade of this device will be carried out in FY 1986-1987. This will allow the exploration of the regimes that theoretically allow even higher beta operation. Achievement of these high values of beta could lead to a significant improvement in the performance of the tokamak concept. This, in turn, could lead to a high power density tokamak reactor core. This budget will also support advanced physics studies of compact, high field ignition devices at PPPL, further tokamak modeling studies at PPPL, advanced toroidal studies at MIT, and initial physics studies of engineering test reactor concepts at LLNL of an international fusion facility in support of the President's initiative.

	FY 1985	FY 1986	FY 1987 Request
Major Device Fabrication..........	$12,225	$14,495	$7,539

This budget will support the modification and upgrade of existing devices to enhance their capabilities to further research in areas suggested by theory and previous experiments.

At PPPL, the upgrading of PBX to PBX-U, which begins in FY 1986, will be completed in FY 1987.

The ATF facility at ORNL will be completed in the first quarter of FY 1987. At GA, procurement of the long pulse ion sources will be completed. Beamline modifications to accommodate the new sources will be completed in FY 1988.

(2) Mirror Confinement Systems..........	54,985	47,148	25,700

The linear tandem mirror represents one of the two basic magnetic confinement configurations which has been shown to confine plasmas of fusion interest. The next appropriate step for the tandem mirror program would be the preparation for operation of the large scaling experiment, MFTF-B. However, recognition that the increasing stringencies in the federal budget will not support the originally planned operating costs for MFTF-B has led to a decision to focus the U.S. fusion effort on the toroidal program. As a result, the MFTF-B facility will be mothballed. Since there is mirror research abroad, an appropriate step is to work toward an international consensus on the best use of the MFTF-B facility in the overall world program. Future operation of the facility in an international context might be one outcome of such a planning activity. By early FY 1987, the fundamental physics of tandem mirrors will have been tested on TMX-U and TARA and work on these two devices will be completed. Most of the specialized personnel and material resources of these programs will then be applied to supporting the toroidal confinement systems. During the remainder of FY 1987 only the small exploratory Phaedrus device at the University of Wisconsin will be operated in the U.S. Collaboration with the Japanese mirror program will be continued in FY 1987.

Tandem Mirror Research Operations..	32,998	31,753	10,700

Of the requested funds, an amount of $1,600,000 will be used for the last year of Phaedrus operation and to continue the collaboration with the Japanese at a level of $600,000. The remainder ($8,500,000) will be used to bring the TMX-U and TARA experiments to a logical conclusion. Future operation of MFTF-B will await the availability of funds and possible international collaboration.

	FY 1985	FY 1986	FY 1987 Request
EBT Research Operations............	$ 988	$ 0	$ 0

Research operation support on the EBT concept was terminated in FY 1985.

Mirror Fusion Test Facility-B......	20,999	15,395	15,000

The funding requested for FY 1987 provides for closeout of current fabrication activities and mothballing of the MFTF-B device. Future operation of this facility will await the availability of funds and possible international collaboration.

B. Capital Equipment.........................	15,400	14,529	7,100
(1) Toroidal Confinement Systems.........	10,450	10,488	7,100

The budget request of $7,100,000 for capital equipment funds provides for ongoing requirements for power supplies, diagnostic instruments, vacuum systems, data acquisition and analysis systems, and miscellaneous test and analysis equipment.

Of the total capital equipment funds, $3,500,000 is requested for TFTR at PPPL for a robotic maintenance manipulator required for limited D-T operation, diagnostic instrumentation, shielding blocks for diagnostics, vacuum systems, and data acquisition equipment including mass storage devices; $1,600,000 is requested for D-III-D at GA Technologies, Inc. for power system switches, a data analysis computer, diagnostic equipment, data acquisition and control hardware, and cryogenic systems; $1,500,000 is requested for ATF at ORNL for vacuum pumps and valves, data acquisition equipment, and diagnostics instrumentation including spectrometers, lasers, and infrared detectors; and $500,000 is requested for PBX at PPPL for electronic components, vacuum systems, and diagnostics hardware.

(2) Mirror Confinement Systems..........	4,950	4,041	0

No funds are requested for FY 1987.

. Development and Technology..................	73,000	61,389	52,400

This subprogram provides for the development of the technologies needed for fusion experiments and for design and analysis of fusion systems. Elements in this subprogram support research on all four major technical issues in the development of magnetic fusion: the development of magnetic confinement systems, the physics of burning plasmas experiment, the development of nuclear technology and the development of fusion materials.

Recent progress in the Development and Technology subprogram area has included tests of three large superconducting magnets in the International Fusion Superconducting Magnet Test Facility (IFSMTF); operation of a multi-pellet pneumatic fuel injector on TFTR; successful demonstration of the long pulse neutral beam development source; development of new concepts for compact, high power R.F. launchers for plasma heating; increased confidence in vanadium as a reduced activation material; first results of steady-state erosion and deposition materials changes using the Plasma Interactive Surface and Components Experimental System (PISCES); design studies of inexpensive copper magnet ignition devices; and definition of nuclear technology testing needs from the Finesse study.

The Development and Technology budget decreases by $8,989,000 in FY 1987. Program efforts are focused on the most critical technology issues. Programs in the areas of Plasma Technologies and Fusion Technologies are important to the successful performance of fusion scientific experiments and are key to understanding the potential of fusion systems to provide energy. Fusion Systems Analysis will continue the exploration of small copper magnet machine designs for ignition experiments and studies in support of the President's international fusion initiative. Existing international cooperative commitments will be fully met.

	FY 1985	FY 1986	FY 1987 Request
A. Operating Expenses........................	$67,900	$57,059	$50,510
(1) Plasma Technologies..................	28,446	22,612	19,720

The FY 1987 budget for Plasma Technologies will continue to support programs that address the key technology issues associated with the components and systems which are used to magnetically confine and sustain high temperature fusion plasmas, but the breadth and depth will necessarily be reduced. The programs include the technologies involved in magnetics, plasma heating, and plasma fueling. The magnetics effort develops the technologies that will enable construction of reliable, cost-effective superconducting and copper magnets for producing the high magnetic fields required to hold and confine hot fusion plasmas. The plasma heating and fueling efforts develop the technologies and components to heat and sustain plasmas for current and future fusion experiments.

The Plasma Technologies development efforts have been extremely productive, resulting in significant technology spinoffs that have reached the commercial state. The Plasma Technologies programs also provide very fertile ground for effective, cost saving international efforts. The IEA Large Coil Task, a major international effort on manufacturing and testing large superconducting magnets continues. Substantial cooperative efforts are also underway in high field superconductors, low temperature materials testing, neutral beam and RF heating technology, and pellet fueling.

Magnetic Systems

The budget request for Magnetics Systems is $10,270,000. Overall, the magnetics effort is lower than FY 1986 because the completion of the last U.S. 8 Tesla large coil in FY 1985 and the coil contract closeout and a one-time State tax payment in FY 1986. In FY 1987, testing of the six-coil array in the International Fusion Superconducting Magnet Test Facility (IFSMTF) will continue from its initiation in FY 1986 and will require a threshold support level to meet our international obligations to operate the IFSMTF until the test objectives have been successfully achieved. A minimum capability will be maintained on the superconducting technology effort since the availability of cost effective magnet designs, either for superconducting or normal systems is a prerequisite in decisions that will have to be made for the design and construction of any next step fusion device.

Heating and Fueling

The budget request for Plasma Heating and Fueling techniques is $9,450,000. The continued progress in experimental fusion plasma physics is directly attributable to the availability of equipment developed in plasma heating and fueling activities during the past several years. Experimentation in higher density and temperature regimes will necessitate higher power and possibly higher frequency electromagnetic wave sources, transmission components, and improved pellet fueling devices. For FY 1987, this budget will maintain essential efforts in these activities, but the remaining neutral beam development efforts will be phased out.

The positive ion neutral beam effort will be reduced to a level that provides support to operating experiments. The negative ion beam effort will be phased out and fusion will rely on the Space Defense Initiative (SDI) to cover this technology development since it is not needed for fusion development in the near term.

Development of radio frequency heating technology will continue with completion of tests on the Radio Frequency Test Facility (RFTF) of the compact, high power launcher and initiation of tests on Doublet-III/TFTR or Tore Supra. Development will focus on those wave launcher types that show the most promise for reliable long pulse operation in high temperature burning plasmas.

Electron Cyclotron Heating (ECH) of plasmas increases the stability of neutral beam and RF heated plasmas. The prime component of ECH systems is the gyrotron in which U.S. industry is the world leader in development and manufacture. Efforts in FY 1987 will be directed at innovative approaches to developing higher power, higher frequency versions of the gyrotron.

The plasma fueling effort is directed towards developing a tritium pellet injector which can produce pellets with a speed greater than the 1 to 2 kilometers/second achieved by the multiple shot injector for TFTR which will be placed in operation in FY 1986. The use of pellet injectors developed in the program during the past two years has enabled the exploration of high density plasmas in several devices and has resulted in stronger world-wide collaboration in fusion research.

	FY 1985	FY 1986	FY 1987 Request
(2) Fusion Technologies..................	$25,414	$22,785	$20,790

The objective of the Fusion Technologies category is to address the critical technology issues concerned with the effects on systems in contact with the plasma and to the neutrons produced by the plasma.

In FY 1987, the requested budget for Fusion Technologies will support three major sub-areas: (1) Fusion Nuclear Technology, (2) Fusion Materials, and (3) Environment and Safety.

The budget requested in FY 1987 will support the overall fusion technologies effort in selected areas consistent with the Magnetic Fusion Program Plan.

Fusion Nuclear Technology

The fusion nuclear technology budget request is $5,665,000. The objective of the Fusion Nuclear Technology element is to develop the major nuclear technologies needed for practical application of fusion energy. Fusion nuclear technology development is one of the key technical issues facing the magnetic fusion program. It addresses fusion systems which must deal with the effects of neutrons, electromagnetic radiation, and a radioactive environment created by fusion devices. The nuclear technology element include nuclear analysis methods, blankets, and tritium processing and control systems.

Activities in blankets will be limited to the most critical feasibility issues associated with the ability of blankets to perform their multiple functions of heat extraction, tritium production, and radiation shielding. In FY 1987, the most critical issue for liquid metal cooled blanket concepts, the effects of magnetic fields on coolant pressures and flows, will be studied experimentally. Major questions about the recovery of tritium from solid breeder materials will be addressed by tests in fission reactors.

Activities in tritium processing and control systems will address the fusion safety requirements for reliably processing, containing, and cleaning potential leakages of tritium generated in the blankets. In FY 1986, individual subsystems of the Tritium Systems Test Assembly (TSTA) at Los Alamos will be tested in preparation for limited full loop operation of TSTA in FY 1987.

An integral part of the Fusion Nuclear Technology element is a program which supports all of the above activities by providing the data bases and analytical methods needed to conduct the nuclear design and analysis of fusion devices. For example, a cooperative program with the Japanese that began in FY 1985 to develop methods for predicting the neutronics performance of tritium breeding materials in fusion reactors will be continued.

In FY 1987, focus will be on the detailed use of existing test facilities, the assessment of various fusion test facility options, and international collaboration in the development of test facilities for nuclear technology development.

Environment and Safety

The Environment and Safety budget request for FY 1987 is $1,400,000. This budget will support activities to develop an understanding of the environmental and safety concerns anticipated in present and future operational fusion facilities.

In the environmental area, work will continue to assess the environmental impacts of magnetic fusion energy devices. In the safety area, work will continue in the areas of tritium waste management, magnets, and the use of reduced activation materials to minimize environmental impacts of fusion.

Fusion Materials

The Fusion Materials budget request for FY 1987 is $13,725,000. The Plasma Materials and High Heat Flux programs provide for tritium permeation and inventory studies at Sandia National Laboratories (SNL), Livermore, CA, in support of the projected TFTR tritium program, full operation of the plasma/materials test facility at SNL, Albuquerque, NM, in support of TFTR coatings program and the upgraded RFP device, and continued operation of the PISCES facility at UCLA.

The program on radiation damage in materials will limit ongoing research on reduced activation materials. The scope of this program is limited to critical materials for fusion systems, including structural and blanket materials. Theory and modeling research in universities and laboratories will be strengthened.

The February 1982 U.S./Japan agreement on RTNS-II will be completed in FY 1987. Discussions will continue on Japanese support for program on high fluence materials radiation damage research in the HFIR fission reactors. Support will be maintained to complete modification of the HFIR fission reactor in order to reduce costs by the transfer of the experimental program from the ORR to HFIR.

	FY 1985	FY 1986	FY 1987 Request
(3) Fusion Systems Analysis.............	$14,040	$11,662	$10,000

The requested budget in this area will support system design studies of experimental machines with burning plasmas, an evaluation of innovative approaches to a test reactor, design concepts for advanced tokamak devices for electrical power production, and systems studies of reversed field pinch devices.

Studies of experimental devices that will be used to produce burning plasmas will be the primary focus of Fusion Systems Analysis in FY 1987. Studies of a tokamak with copper toroidal field coils for an ignition device will continue, based on work performed in FY 1986. The objective is to identify the most cost effective path to complete such an ignition experiment.

A second focus for the Fusion Systems Analysis area is design studies of an international fusion facility in support of the President's initiative for international collaboration in fusion. This request also supports the completion of a design study for a reversed field pinch device.

Support will continue for the International Tokamak Workshop (INTOR) being conducted by the International Atomic Energy Agency (IAEA) with the participation of the United States, the Soviet Union, European Community, and Japan.

	FY 1985	FY 1986	FY 1987 Request
B. Capital Equipment........................	$ 5,100	$ 4,330	$ 1,890

The FY 1987 requirements for capital equipment in the Development and Technology subprogram total $1,890,000, a decrease of $2,440,000 from the FY 1986 level, and are highlighted below:

(1) Plasma Technologies..................	3,386	2,309	680

The capital equipment request to support Plasma Technologies activities is $680,000, a reduction of $1,629,000 from FY 1986. Funds are requested to support the High Field Test Facility, the RF Test Facility, pellet injector development, RF development, and base technology efforts.

(2) Fusion Technologies..................	1,714	2,021	1,210

Capital equipment funds are requested to support the experimental research programs in materials, safety, and nuclear technology which include the Plasma Materials Test Facility (PMT), the Plasma Surface Interaction Experiment (PISCES), liquid metal test loop, tritium testing facilities, the Tritium Systems Test Assembly (TSTA), and for radiation facilities at the Oak Ridge Reactor as well as modification to the High Flux Isotope Reactor at Oak Ridge and for the Fast Flux Test Facility at Richland which are employed in the materials irradiation programs.

IV. Planning and Projects.........................	48,501	21,982	16,800
A. Operating Expenses........................	12,201	5,528	4,780

A sum of $3,776,000 is requested to cover the program's legal obligation to support the Small Business Innovative Research (SBIR) program. The remainder is requested to support non-fusion landlord responsibilities for inventories at ORNL.

B. Capital Equipment........................	3,800	3,801	3,820

The FY 1987 request of $3,820,000 for capital equipment permits the purchase of general purpose equipment to support non-fusion specific landlord responsibilities at ORNL.

These funds will be used to replace obsolete or worn equipment as well as to provide new state-of-the-art equipment at the laboratory.

C. Construction.............................	32,500	12,653	8,200

The FY 1987 construction budget request of $8,200,000 is entirely for general plant projects. These funds will support projects at several laboratories to meet health, safety, and programmatic requirements and to provide for miscellaneous modifications, additions, alterations, replacements and non-major new construction items to meet programmatic goals. This will allow us to provide continuity of operation, improvement to economy, minor changes in operating methods and protection of the Government's investment by preventing excessive deterioration of facilities. Of the total funding requested, $7,200,000 is provided to ORNL, $500,000 to PPPL, $200,000 to LLNL, and $300,000 to LANL. It is noted that at ORNL the Magnetic Fusion Energy program has the responsibility to provide funding for all of the general purpose plant needs for this multipurpose laboratory.

	FY 1985	FY 1986	FY 1987 Request
V. Program Direction	$ 4,150	$ 3,608	$ 4,000
Total FTE's	66	62	62

The FY 1987 request for Magnetic Fusion Energy Program Direction is $4,000,000. These funds are required to provide for personnel and other costs associated with continuation of 62 full-time equivalents.

The manpower base supported under this account provides the technical management expertise needed to direct and administer the highly scientific and technical research and development program in fusion energy. Staff activities include: policy development; preparation of technical research and development plans; assessment of scientific needs and priorities; development and defense of budgets; review, evaluation, and funding of research proposals; monitoring, evaluation, and direction of laboratory work and allocation of resources; implementation of university and industrial research programs, as well as construction projects; interagency and international liaison; and related administrative and program support activities.

Management improvements, such as increased use of office automation, assignment of some specific responsibilities to field offices and major mission assignments to laboratories, have been implemented in recent years to assist with certain workload requirements involved in managing this highly technical program. The recent shift in emphasis from construction to operation of fusion research test facilities has created increased workload in managing these facilities. Increased planning and both interlaboratory and international coordination are required to achieve effective utilization of existing major facilities and funding resources in addressing major technical and engineering issues. Updating the overall program plan and individual subprogram plans to reflect a significant redirection of effort in physics research and technology development is continuing. Support of the design and conceptual work on an ignition experiment and on the advanced concept initiatives begun in FY 1986 will continue.

The program is increasingly involved in international collaboration. This has expanded from a scientific exchange program with the Soviets to include major hardware cooperation programs with Japan and the European Community involving tens of millions of dollars annually and hundreds of scientists. Evaluation of current international activities is required to take advantage of opportunities for new cooperative programs and to avoid duplicative work. The Office of Fusion Energy staff must assure that both the content and the balance of the exchange programs are appropriate. Negotiations, intragovernmental liaison, and participation in international working groups dealing with both technical and managerial aspects of projects are very demanding of staff time.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
OPERATING EXPENSE FUNDED PROJECT DATA SHEET
ENERGY RESEARCH

Energy Supply Research and Development - Operating Expenses
Magnetic Fusion

(Tabular dollars in thousands. Narrative material in whole dollars.)

Advanced Toroidal Facility (ATF)
Oak Ridge National Laboratory

Total Estimated Cost (TEC): $19,900,000
(For Design and Construction)

Advanced Toroidal Facility (ATF)
Oak Ridge National Laboratory

Total Estimated Cost (TEC): $19,900,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

	Cumulative Prior Years	FY 1985 Actual		FY 1986 Estimate		FY 1987 Estimate		Total Project Funding
	Obs.	B/A	B/O	B/A	B/O	B/A	B/O	B/A
Fabrication								
Operating Expenses (DOE):								
Design and Construction	$ 8,025	$ 6,425	$ 6,768	$ 4,744	$10,389	$ 706	$ 863	$19,900
Subtotal	8,025	6,425	6,768	4,744	10,389	706	863	19,900
Related Funding Requirement								
Capital Equipment	950	218	66	0	0	0	0	1,168
Research Operations	2,365	626	802	155	221	0	0	3,146
Subtotal	3,315	844	868	155	221	0	0	4,314
Total Project	$11,340	$ 7,269	$ 7,636	$ 4,899	$10,610	$ 706	$ 863	$24,214

Description Objective and Justification

The existing ISX-B tokamak facility is being modified to test the physics of steady-state, high beta toroidal configurations, which potentially could provide significant advantages for proposed toroidal fusion reactors. The modified device, ATF, is intended to test beta limits and collisionless transport in a current-free steady-state stellarator/torsatron configuration.

Recent experimental results obtained in stellarators/torsatrons in Japan and Germany have renewed interest in the U.S. in utilization of helical windings to achieve steady-state operation of toroidal fusion reactors. The present stellarator devices are, however, relatively small with limited confinement capability. ATF is intended to test stellarator confinement and beta limits at a level comparable with tokamaks such as ISX-B and PLT. It will be the only major U.S. facility in the next few years to carry out experiments on stellarators.

Description, Objective and Justification (continued)

The basic ATF device consists of a helical stellarator coil set, three vertical field coils, an ohmic heating system, and a vacuum vessel. Magnetic configuration flexibility, large cross section and good access are important design considerations. It will utilize a significant part of the existing ISX-B facilities, including power supplies, neutral beam systems, instrumentation and control systems, utilities, diagnostics, etc.

The conceptual design was conducted in FY 1983. The period from FY 1983 through FY 1986, inclusive, will be used for design (Title I and II Engineering) acceptance testing, procurement of the necessary hardware, and installation of the hardware.

(a) Schedule of Planned Activities

Activity	Start	Complete
Conceptual Design	4Q FY 1982	2Q FY 1983
Procurement	4Q FY 1983	4Q FY 1985
Final Design	4Q FY 1983	2Q FY 1986
Fabrication	3Q FY 1984	4Q FY 1986
Assembly	2Q FY 1985	1Q FY 1987
Startup	1Q FY 1987	

(b) Management and Contracting

A project manager was appointed using existing Martin Marietta Energy Systems, Inc. (MMES) procedures. Design was done by the MMES Engineering Division. Procurement will be through MMES's Purchasing Division using guidelines approved by DOE/ORO. Most items will be procured from outside vendors. A construction contractor will do site preparation and construction work using DOE/ORO guidelines.

(c) Prior Year Achievements

Title I and II design of all components including helical coils, vacuum vessel and structural shell are completed and contracts for procurements were placed. Prototype helical coil segment was fabricated and tested. The delivery of major components including helical field conductor and structural tee sets, structural shell segments, and vacuum vessel will be completed. Field assembly of the device will be initiated.

Advanced Toroidal Facility (ATF)
Oak Ridge National Laboratory

Total Estimated Cost (TEC): $19,900,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

(d) Current Year Achievements

The assembly of the facility and its commissioning will be completed.

(e) Reasons for Increases and Decreases

The increase in the TEC from $19,300,000 to 19,900,000 is due to the added scope to the project. A new set of mid-vertical field coils were added to improve the flexibility of the facility.

(f) Cost Estimate

Engineering, Design and Inspection	$ 4,740
Procurement and Construction Costs	14,091
Contingency	1,069
Total	$19,900

Escalation is included at 8.5% per year.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
OPERATING EXPENSE FUNDED PROJECT DATA SHEET
ENERGY RESEARCH

Energy Supply Research and Development - Operating Expenses
Magnetic Fusion

(Tabular dollars in thousands. Narrative material in whole dollars.)

Field Reversed Configuration (FRC) Physics Experiment
Spectra Technology

Total Estimated Cost (TEC): $8,000,000
(For Design and Construction)

FRC Physics Experiment
Spectra Technology*

Total Estimated Cost (TEC): $8,000,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1986 Estimate		FY 1987 Estimate		FY 1988 Estimate		FY 1989 Estimate		Total Project Funding
	B/A	B/O	B/A	B/O	B/A	B/O	B/A	B/O	B/A
Fabrication									
Operating Expenses	$ 1,075	$ 1,075	$ 2,425	$ 2,425	$ 3,050	$ 3,050	$ 1,450	$ 1,450	$ 8,000
Subtotal	1,075	1,075	2,425	2,425	3,050	3,050	1,450	1,450	8,000
Related Funding Requirement									
Research Operations	1,120	1,120	1,475	1,475	1,055	1,055	500	500	4,150
Subtotal	1,120	1,120	1,475	1,475	1,055	1,055	500	500	4,150
Total Project	$ 2,195	$ 2,195	$ 3,900	$ 3,900	$ 4,105	$ 4,105	$ 1,950	$ 1,950	$12,150

Description, Objective and Justification:

The term field reversed configuration (FRC) refers to a special class of elongated toroidal plasma equilibria contained in a solenoidal magnetic field; the magnetic field is purely poloidal. Technological advances and increased understanding of FRC physics and formation processes have resulted in rendering the FRC a unique and promising approach to fusion power. Its promise arises from the extremely high beta values (of order unity) and its observed ruggedness.

The objective of this experiment is to achieve conditions at which fusion-relevant confinement and stability can be tested. This objective is characterized by a parameter S-the average number of ion orbits between the center and edge of the plasma. Present experiments operate at S of 2-3. Immediate extrapolation to the reactor-required S of 30 would be costly. However, theoretical predictions show that at S = 8 conditions are achieved similar to those encountered in a fusion plasma, and this value has been chosen as a cost-effective near term goal.

The hardware required to meet the experimental objectives are: large diameter plasma discharge tube, vacuum vessel and accompanying support structure, high voltage power supply banks, and ignition switches for capacitors. There will also be costs related to space preparation. The experiment will be designed to achieve a plasma condition of 64-cm-diam, 200-cm length, $3.5 \times 10^{15} cm^{-3}$ particle density, 350 eV temperature, energy confinement time of 2 milliseconds, and fusion Lawson parameter of 2×10^{12} sec-cm^{-3}.

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*This project will be constructed at Spectra Technology which is non-Government owned property.

FRC Physics Experiment
Spectra Technology

Total Estimated Cost (TEC): $8,000,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

(a) Schedule of Planned Activities

Activity	Start	Completion
Device Design	3Q FY 1986	2Q FY 1987
Fabrication and Installation	4Q FY 1986	2Q FY 1989
Begin Operations	3Q FY 1989	Indefinite

(b) Management and Contracting

The technical requirements and experimental objectives have been established during a technical planning effort with experts in the field reversed configuration topical area. Outside reviews have supported the timing and confirmed the experimental objectives. The contractor is Spectra Technology in Bellevue, Washington.

(c) Prior Year Achievements

Technical proposal for project was reviewed and pre-conceptual design, project approach and program goals were accepted.

(d) Current Year Achievements

A contract will be negotiated and the project management team will be established. Final cost and schedule projections will be completed after a final project review is conducted in the first quarter of FY 1987.

(e) Reasons for Increases and Decreases

Total estimated cost (TEC) has been reduced from the $9,700,000 requested in the FY 1986 Congressional budget to the $8,000,000 contained herein. The device size and energy storage requirements have been reduced as a result of the technical review of the proposal.

FRC Physics Experiment
Spectra Technology

Total Estimated Cost (TEC): $8,000,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

(f) Cost Estimate (Cost estimate is preliminary)

Engineering and Design	$ 1,100
Procurement and Fabrication	4,000
Assembly and Installation	1,700
Contingency	1,200
Total	$ 8,000

Escalation is included at 5% per year.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
OPERATING EXPENSE FUNDED PROJECT DATA SHEET
ENERGY RESEARCH

Energy Supply Research and Development - Operating Expenses
Magnetic Fusion

(Tabular dollars in thousands. Narrative material in whole dollars.)

Reversed Field Pinch
Los Alamos National Laboratory (LANL)

Total Estimated Cost: $32,300,000
(For Design and Construction)

Reversed Field Pinch
Los Alamos National Laboratory

Total Estimated Cost: $32,300,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1986 Estimate		FY 1987 Estimate		FY 1988 Estimate		FY 1989 Estimate		FY 1990 Estimate		Total Project Funding
	B/A	B/O	B/A	B/O	B/A	B/O	B/A	B/O	B/A	B/O	B/A
Fabrication											
Operating Expenses	$ 3,420	$ 3,220	$ 6,600	$ 6,400	$ 8,680	$ 8,680	$ 9,700	$ 9,700	$ 3,900	$ 4,300	$32,300
Subtotal	3,420	3,220	6,600	6,400	8,680	8,680	9,700	9,700	3,900	4,300	32,300
Related Funding Requirement											
Research Operations	915	915	1,400	1,400	485	485	0	0	0	0	2,800
Capital Equipment	3,647	3,647	3,000	3,000	2,153	2,153	2,400	2,400	6,200	6,200	17,400
Subtotal	4,562	4,562	4 400	4,400	2,638	2,638	2,400	2,400	6,200	6,200	20,200
Total Project	$ 7,982	$ 7,782	$11,000	$10,800	$11,318	$11,318	$12,100	$12,100	$10,100	$10,500	$52,500

Description, Objective and Justification

The presently operating reversed field pinch (RFP) devices have achieved outstanding experimental results which surpass design specifications for the devices. For example, in ZT-40M, experimental duration has reached 25 milliseconds exceeding the design goal of 2 millisecond. During the recent review of certain fusion development issues, the Magnetic Fusion Advisory Committee recommended proceeding with the physics exploration of the reversed field pinch concept. The importance of extending the current capability to values in the megampere range in order to test energy confinement was emphasized. As a result, a device will be fabricated which will have an initial current performance of 2 megamperes (MA) with subsequent increase to 4 MA. This will bring to the fusion program an experimental capability that increases first wall heat flux, provides information on tokamak-like operating modes, high magnetic field shear, physics of MHD beta limits, and MHD minimum energy states.

Total Estimated Cost: $32,300,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

Description, Objective and Justification (continued)

The device will consist of magnetic field coils, vacuum system, control system, and structural support systems. Related project funding will provide a power supply system from capital equipment funds and the required physics and engineering support from operating expense funds. The initial capability of the device will be 2 megamperes of current, but the device will be upgradable using additional power supply systems to achieve 4 MA. Technical goals will include minimization of magnetic field errors, design of plasma limiters for high heat flux, first-wall thermal loading (1.5 to 5 MW/m^2), and steady state operational capabilities.

The funding profile shown will allow fabrication to begin in FY 1986, and construction to be complete in CY 1989.

(a) Schedule of Planned Activities

Activity	Start	Complete
Device Design	1Q FY 1986	2Q FY 1987
Procurement	2Q FY 1986	1Q FY 1989
Fabrication and Installation	3Q FY 1986	1Q FY 1990
Plasma Operations	2Q FY 1990	Indefinite

(b) Management and Contracting

The Los Alamos National Laboratory (LANL) has been assigned responsibility for this project. The LANL management team is being organized and is expected to be complete by the third quarter of FY 1986. An objective of the RFP program is to involve other U.S. institutions that have skills needed for RFP development. To achieve this end, a competitive solicitation is to be accomplished during FY 1986. This solicitation will seek to attract parties interested in a cost shared joint participation in this project. Representatives from such a participant shall be expected to participate fully in the project management.

(c) Prior Year Achievements

Technical proposal for the project was reviewed, and pre-conceptual design, project technical approach and program goals were established. This included the recommendation to incorporate certain changes in the initial hardware that make it capable of 4MA operations. This includes the immediate acquisition of a single motor-generator adequate for the ultimate capability.

Reversed Field Pinch
Los Alamos National Laboratory

Total Estimated Cost: $32,300,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

(d) Current Year Achievements

A contractor and site has been selected and the project management team is being organized. The Los Alamos National Laboratory has been assigned responsibility for this project. It will be sited in the target chamber hall of the Antares facility at LANL. Final cost and schedule projections will be completed during the third quarter of FY 1986.

(e) Reasons for Increases and Decreases

The decision to provide partially for the 4 megampere plasma current capability resulted from an examination of the world-wide reversed field pinch program and the guidance provided during the FY 1986 appropriation process. This decision affects only slightly the cost and schedule to achieve the 2 megampere operation described in the FY 1986 budget submission. The full 4 megampere current capability will be provided by the fourth quarter of FY 1991. The procurement items called for in FY 1990 are predominantly additional power conversion equipment needed for the higher current capability.

(f) Cost Estimate (Cost estimate is preliminary)

Engineering and Design	$ 5,100
Procurement and Fabrication	20,400
Assembly and Installation	4,600
Contingency	2,200
Total	$32,300

Escalation is included at 5% per year.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
OPERATING EXPENSE FUNDED PROJECT DATA SHEET
ENERGY RESEARCH

Energy Supply Research and Development - Operating Expenses
Magnetic Fusion

(Tabular dollars in thousands.   Narrative material in whole dollars.)

DIII-D Extended Pulse Neutral Beams
GA Technologies, Inc.

Total Estimated Cost: (TEC) $7,400,000
(For Design and Construction)

DIII-D Extended Pulse Neutral Beams
GA Technologies, Inc.*

Total Estimated Cost (TEC): $7,400,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

	Cumulative Prior Years	FY 1986 Estimate		FY 1987 Estimate		FY 1988 Estimate		Total Project Funding
	Obs.	B/A	B/O	B/A	B/O	B/A	B/O	B/A
Fabrication:								
Operating Expenses	$ 0	$ 2,371	$ 2,371	$ 3,000	$ 3,000	$ 2,029	$ 2,029	$ 7,400
Subtotal	0	2,371	2,371	3,000	3,000	2,029	2,029	7,400
Total Project	$ 0	$ 2,371	$ 2,371	$ 3,000	$ 3,000	$ 2,029	$ 2,029	$ 7,400

Description, Objective and Justification

The Doublet III facility with the new Dee-shaped vacuum vessel installed (DIII-D) will be the U.S. fusion program's most flexible tokamak facility with a performance capability in hydrogen approaching that of TFTR and JET. DIII-D will operate at lower magnetic field than TFTR, but with a plasma shaping capability that is more flexible than that of JET. The toroidal program plans to rely heavily on DIII-D through the 1980's to provide the information necessary to understand the physics of shaped plasmas with parameters approaching those of fusion plasmas. To fulfill its role in the toroidal program it will be necessary for the DIII-D facility to extend its pulse length to several seconds. Longer pulse heating is required to bring the larger DIII-D plasma to equilibrium and then to study the stability of that high beta equilibrium. Also, many of the physics phenomena of interest evolve over a period of several seconds.

The DIII-D facility, as presently planned, will be capable of multisecond plasma discharges but will lack a multisecond plasma heating capability. This project will provide for the upgrade of the four existing neutral beam injection systems for 5 second operation and 14 MW of injected power. Two of the neutral beam injection systems were provided by JAERI through the U.S./Japan cooperative program on D-III. This project will allow high quality plasma parameters to be sustained for up to 10 seconds. This is the most cost effective means of obtaining this level of auxiliary heating capability.

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*This project will be constructed at GA Technologies, Inc., which is non-Government owned property.

DIII-D Extended Pulse Neutral Beams
GA Technologies, Inc.

Total Estimated Cost (TEC): $7,400,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

Description, Objective and Justification (continued)

The extended pulse heating will allow the plasma temperature in DIII-D to be increased into the low collisionality regime and sustained for several seconds providing sufficient time for detailed investigations to be conducted. As the plasma discharge approaches the collisionless regime, its characteristics are theoretically predicted to change. The transport is altered, therefore, the confinement properties are changed. In addition, the plasma pressure is elevated, producing changes in the MHD activity and the stability of the plasma configuration. The physics of this regime have been studied theoretically, but definitive experiments have not been possible because the proper plasma conditions could not be achieved. Experiments conducted with DIII-D using the modified neutral beam injection systems are expected to greatly expand our scientific knowledge of this regime.

During 1987, work will be completed on modification of the two neutral beam injection systems for five second operation. Procurement of the new long pulse ion source will be completed and operation of two modified beamlines will begin.

(a) Schedule of Planned Activities

Activity	Start	Complete
Design	1Q FY 1986	3Q FY 1986
Fabrication	2Q FY 1986	2Q FY 1987
Installation	3Q FY 1986	3Q FY 1987
Startup	4Q FY 1986	2Q FY 1988

(b) Management and Contracting

This project will be managed by GA Technologies, Inc., San Diego, California, under separate contract.

(c) Prior Year Achievements

One neutral beam injection system was modified for five second operation. Two long pulse ion sources were procured and installed in the first beam line and tested at full power.

DIII-D Extended Pulse Neutral Beams
GA Technologies, Inc.

Total Estimated Cost (TEC): $7,400,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

(d) Current Year Expectations

Modify a second beamline and procure the remaining seven long-pulse ion sources.

(e) Reasons for Increases and Decreases

The cost estimate for the long-pulse ion source procurement from RCA has increased. The project completion date has been postponed because of budget reductions.

(f) Cost Estimate

Engineering and Design	$ 800	
Fabrication and Installation	5,700	
Contingency	900	
	$ 7,400	Escalation is included at 5% per year.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT - PLANT AND CAPITAL EQUIPMENT
MAGNETIC FUSION
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: General plant projects

2. Project No.: 87-R-901

3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 2nd Qtr. FY 1987

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: None
Date:

6. Current cost estimate: $8,200
Date: December 1985

7. Financial Schedule:

Fiscal Year	Obligations	Costs			
		FY 1985	FY 1986	FY 1987	After FY 1987
Prior Year Projects	XXXXXXXX	$ 4,245	$ 3,479	$ 2,862	$ 0
FY 1985 Projects	$ 9,400	3,255	4,330	1,815	0
FY 1986 Projects	8,764	0	2,697	4,099	1,968
FY 1987 Projects	8,200	0	0	2,711	5,489
		$ 7,500	$ 10,506	$ 11,487	$ 7,457

8. Brief Physical Description of Project

These projects provide for the many miscellaneous alterations, additions, modifications, replacements, and non-major new construction items required annually to provide continuity of operation, improvement in economy, road and street improvements, elimination of health and safety hazards, minor changes in operating methods, and protection of the Government's significant investment in facilities at the present time. The continuing review of our requirements will result in some of the projects being changed in scope; it will also result in other projects being added to the list with the necessary postponements of some now listed, all depending on conditions or situations not apparent at this time.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: General plant projects

2. Project No.: 87-R-901

8. Brief Physical Description of Project (continued)

The currently estimated distribution of FY 1987 funds by office is as follows:

1.	Los Alamos National Laboratory	$ 300
2.	Lawrence Livermore National Laboratory	200
3.	Princeton Plasma Physics Laboratory	500
4.	Oak Ridge National Laboratory	7,200
		$ 8,200

9. Purpose, Justification of Need for, and Scope of Project

The following are tentative examples of the major items to be performed at the various locations:

Los Alamos National Laboratory	$ 300

Requirements include laboratory and office modifications, and additions and upgrading of building service systems as required to meet programmatic goals of the Magnetic Fusion Energy program.

Lawrence Livermore National Laboratory	$ 200

NMFECC Tape Vault

Princeton Plasma Physics Laboratory		$ 500*
Safety and fire protection improvements, system modifications and alterations.	100	
Repair by replacement CICADA HVAC units	350	
Miscellaneous small projects	50	

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*These projects will be constructed at the Princeton Plasma Physics Laboratory which is non-Government owned property.

1. Title and location of project: General plant projects

2. Project No.: 87-R-901

9. Purpose Justification of Need for, and Scope of Project (continued)

Oak Ridge National Laboratory.. $ 7,200

These funds cover the Magnetic Fusion Energy program's responsibility to fund all of the generic General Purpose Plant projects needs at this multipurpose laboratory.

Air Conditioning Central Mechanical Shops	$ 160
Laboratory Improvements, Biology Administration and Research Building	200
Replace Elevator 2, Biological Research Facility	450
East Parking Lot Lighting Replacement	125
Radiochemical Reprocessing Plant-Evacuation Alarms and Remote Monitoring	95
Fire Protection Installation, Central Research Library	60
Steam Plant Storage Building	52
Computer Science Research Facility	985
Toxic Substance Inhalation Facility	700
Backup Tape Storage Vault	180
New Facilities for Safety, Security, and Efficiency	100
Radiochemical Reprocessing Plant Public Address and Intercom System	255
Separation Science and Technology Facility	650
High Bay Engineering Offices and Laboratories	470
Switchgear Modernization, Biology Research Laboratory Building	830
Facility Upgrade	658
Balance Negative Air Pressure, Fusion Energy Administration, Research Building	280
Containment, Ventilation, Air Routing and Control Systems	950

Since needs and priorities may change, other projects may be substituted for those listed, and some of these may be located on non-Government owned property.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: General plant projects 2. Project No.: 87-R-901

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10. Details of Cost Estimate

Not available at this time.

11. Method of Performance

Design and engineering will be on the basis of negotiated subcontracts and construction work under fixed price subcontracts awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

This item does not apply to general plant projects.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

This item does not apply to general plant projects.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
OPERATING EXPENSE FUNDED PROJECT DATA SHEET
ENERGY RESEARCH

Energy Supply Research and Development - Operating Expenses
Magnetic Fusion

(Tabular dollars in thousands. Narrative material in whole dollars.)

PBX Upgrade
Princeton Plasma Physics Laboratory

Total Estimated Cost: $9,200,000
(For Design and Construction)

PBX Upgrade
Princeton Plasma Physics Laboratory*

Total Estimated Cost: $9,200,000

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Actual		FY 1986 Estimate		FY 1987 Estimate		Total Project Funding
Fabrication	B/A	B/O	B/A	B/O	B/A	B/O	B/A
Operating Expenses	$ 0	$ 0	$ 5,367	$ 5,367	$ 3,833	$ 3,833	$ 9,200
Subtotal	0	0	5,367	5,367	3,833	3,833	9,200
Total Project	$ 0	$ 0	$ 5,367	$ 5,367	$ 3,833	$ 3,833	$ 9,200

Description, Objective and Justification

The presently operating PBX will be modified to allow for increased beta operation in high aspect ratio tokamaks. The upgrade will include reconfiguring the pusher coil to produce higher indentation H-mode operation and adding passive stabilizer plates to control disruptions attributed to external kink modes. The goal is to achieve the highest possible beta operation since beta is a direct measure of the efficiency of magnetic field utilization.

To date all tokamak maximum beta values have been determined by the Troyon limit, which states that beta is proportional to plasma current and inversely proportional to plasma radius and toroidal magnetic field. PBX Upgrade seeks to exceed this theoretical first stability regime limit by indenting the plasma, thereby suppressing the internal kink and ballooning modes. By means of shaping the plasma and passively stabilizing the instabilities, PBX Upgrade should be able to demonstrate whether or not access can be gained to the region of second stability and the correspondingly higher beta values.

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*The project will be constructed at the Princeton Plasma Physics Laboratory which is non-Government owned property.

(Tabular dollars in thousands. Narrative material in whole dollars.)

Description, Objective and Justification (continued)

(a) Schedule of Planned Activities

Activity	Start	Complete
Conceptual Design	1Q FY 1985	1Q FY 1986
Stop PBX Operation	1Q FY 1986	
Fabrication of Parts	2Q FY 1986	1Q FY 1987
Installation of Plates and Coils	3Q FY 1986	1Q FY 1987
Start PBX-Upgrade Operation	2Q FY 1987	

(b) Management and Contracting

This project will be managed by PPPL, Princeton, New Jersey.

(c) Prior Year Achievements

Engineering design was completed. Fabrication and installation of the passive plates, pusher coil, and modification of power supplies and diagnostics commenced.

(d) Current Year Achievements

The upgrade will be completed in the second quarter of FY 1987. Full scale operation will begin in the third quarter of FY 1987.

(e) Reasons for Increases and Decreases

N/A

Description, Objective and Justification (continued)

(f) Cost Estimate (Cost estimate is preliminary)

Engineering and Design	$ 2,000
Fabrication	6,000
Contingency	1,500
Total	$ 9,500

Supporting Research
and Technical Analysis

DEPARTMENT OF ENERGY
FISCAL YEAR 1987 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
VOLUME 3
SUPPORTING RESEARCH AND TECHNICAL ANALYSIS

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DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
PROGRAM OVERVIEW

SUPPORTING RESEARCH AND TECHNICAL ANALYSIS

Developing new and improving the use of current energy sources continues to be of fundamental importance to the general health and welfare of the nation and its economy. The role of supporting research and technical analysis is to expand the scientific and engineering knowledge base on which the Nation's future energy options depend and to provide independent, objective analyses and assessments of research and technical needs relating to energy. The applied technology efforts of industry and government need this broad knowledge base to devise new concepts, develop new materials, and devise new and improved processes and techniques for energy production, conversion and utilization. We must continue to strengthen our understanding of the scientific basis of energy-related phenomena to overcome limitations on productivity growth, erosion of the country's competitive position with foreign nations and additional pressure on the United States balance of trade.

Seven programs comprise the Office of Energy Research's portion of the Supporting Research and Technical Analysis category of the agency's budget: (1) Basic Energy Sciences (BES); (2) Energy Research Analysis (ERA); (3) Advisory and Oversight Program Direction; (4) University Research Support (URS); (5) University Research Instrumentation (URI); (6) Multiprogram Energy Laboratories Facilities Support (MEL-FS); and (7) Policy and Management.

The mission of the Basic Energy Sciences (BES) program is to carry out long range, basic research activities needed to enhance this base. The major product of the BES program continues to be increased knowledge which becomes a part of the body of data on which applied technologies rest. In addition to a major focus on disciplinary research, there is also emphasis on innovative applications of new knowledge to energy problems, and on the early application of the results. In support of these activities, the BES program provides the major support for operating the large, unique scientific user facilities required for research in the physical and life sciences.

The U.S. has been the world leader in science and technology and has derived many economic benefits from its leadership. The Department of Energy and its multiprogram laboratories play an important role in the nation's scientific enterprise that is essential for our preeminence. A central feature of this role has been the construction and operation of large, specialized scientific facilities that are used by scientists from universities and industry as well as the national laboratories. Many of the scientific facilities in our multiprogram laboratories are old or are becoming old and their scientific productivity will soon become marginal. In order to make further progress in certain fields, new, more powerful facilities are required.

In the past few years, the Department has given special attention to correcting deficiencies at its laboratories in environment, health, safety, security, safeguards, multiprogram general purpose facilities and other such areas. However, less attention has been paid to improving the essential scientific facilities required to accomplish the main mission of the laboratories, i.e., to be preminent in certain key fields of research. In 1987 a Scientific Facilities Upgrade, directed toward solving this problem will be initiated. It includes four facilities that have been identified by the scientific community as being the most critical to the future needs of the Department's basic research programs. The four facilities, all of which will be located at the multiprogram laboratories, are: a 1-2 GeV Synchrotron Radiation Source - Lawrence Berkeley Laboratory, a 6 GeV Synchrotron Radiation Source - Argonne National Laboratory, an Advanced Steady State Research Reactor - Oak Ridge National Laboratory; and a Relativistic Heavy Ion Collider - Brookhaven National Laboratory.

The Energy Research Analysis (ERA) program provides the capability for independent, rigorous assessment of the base of research that underlies a variety of energy technologies. Assessments are consolidated under one organization, the Office of Energy Research, in fulfillment of legislated responsibility for the Director of Energy Research to advise the Secretary on the agency's research and development programs.

The University Research Support (URS) program consists of two major subprograms and a set of program activities focused on the following three primary objectives: (1) to strengthen university capability to do energy research; (2) to strengthen the quality and increase the number of students interested in pursuing energy-related professional careers; and (3) to enhance technology transfer activities through cooperative research efforts between universities, the agency's national laboratories and private industry. The first subprogram, University Laboratory Research, is directed at strengthening the capabilities of both universities and national laboratories as major energy research performers in the conduct of long range energy research. Many of the activities supported within this subprogram involve joint efforts between university and laboratory-based researchers. The second subprogram, Energy Manpower Development, includes efforts to increase the number of students pursuing energy-related engineering and science careers. This subprogram also includes the Department's statutory responsibility for assessing the supply and demand of manpower for both current and projected energy R&D programs.

The University Research Instrumentation (URI) program provides grants to major research universities to purchase state-of-the-art, scientific instrumentation used in energy-related research areas such as materials characterization, biological research, catalysis, health effects, and engineering research.

The Multiprogram Energy Laboratories-Facilities Support (MEL-FS) Program is to provide for the rehabilitation, upgrade, and replacement of general purpose facilities at the five multiprogram energy laboratories: Argonne National Laboratory (ANL), Brookhaven National Laboratory (BNL), Lawrence Berkeley Laboratory (LBL), Oak Ridge National Laboratory (ORNL), and Pacific Northwest Laboratory (PNL). These Government-owned sites are complete research reservations with unique research facilities including laboratories and offices and all necessary support facilities and systems such as administrative offices, craft shops, warehouses, security facilities, fire houses, cafeterias, and all required utility distribution systems plus steam generation plants, sewage and other waste treatment facilities, roads and other structures. These laboratories have performed national research programs for the Department and its predecessor agencies for nearly 40 years and continue to do so primarily in the areas of energy supply research and development and general sciences research (e.g., nuclear energy, fusion energy, basic energy sciences, nuclear physics, high energy physics, life sciences, fossil energy, solar energy and conservation.) Over 17,000 scientists, engineers and other support staff are engaged in these activities.

The MEL-FS program consists of two subprograms. The first subprogram, Multiprogram Energy Laboratories-General Purpose Facilities (MEL-GPF) originated in FY 1981 to rehabilitate, upgrade, and replace as appropriate deficient buildings, utilities, roads, railroads and other facilities at the multiprogram laboratories. This is necessary because through continuous use, aging and changing technology, facilities and related support systems deteriorate (both physically and in performance) to a point where they are no longer appropriate for their intended functions, economically justifiable to maintain, or adequate to meet security, environmental, safety, and health requirements. Thus, this program helps ensure that the capital asset base is adequate for continued effective accomplishment of the Department's R&D mission today and in the future.

The ORNL Environmental Compliance Upgrade Subprogram originated in FY 1985 to address environmental deficiencies that relate to non-defense activities at ORNL. The actions fall into two categories: those that concern the modification, replacement or upgrade of existing processes for handling wastes and those that relate to the clean-up of inactive contaminated facilities and sites. A multiyear effort will be needed to bring ORNL's active and inactive systems into compliance with existing applicable environmental regulations.

Advisory and Oversight Program Direction provides funds for the personnel resources required by the Director of Energy Research to carry out his responsibilities specifically assigned by legislation (P.L. 95-91), as well as those mandated by the Secretary of the Department of Energy, in areas beyond the scope of the Office of Energy Research programs. This staff has the responsibility to advise the Secretary with respect to the well-being and management of the multiprogram laboratories; to administer the Department's R&D Laboratory Technology Transfer Program; to supervise or support research activities carried out by any of the Assistant Secretaries; to provide for institutional planning by the Multiprogram Laboratories; and to provide for program management of the Energy Research Analysis, University Research Support, and Multiprogram Energy Laboratories-Facilities Support programs. The program provides funds only for the salaries and related personnel expenses for the personnel who carry out the studies, analyses, monitoring and coordination activities required to support the Director of the Office of Energy Research and the Secretary.

The Office of Energy Research Policy and Management program provides for the salaries and related expenses associated with staff in the immediate office of the Director of Energy Research.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
BASIC ENERGY SCIENCES
Energy Supply Research and Development - Operating Expenses
Energy Supply Research and Development - Plant and Capital Equipment

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
Basic Energy Sciences					
Materials Sciences					
Operating Expenses..........	$132,227	$134,248	$134,248	$156,931	$+22,683
Capital Equipment...........	15,450	11,979	11,979	15,500	+ 3,521
Construction................	36,580	42,333	42,333	23,960	-18,373
Subtotal..................	$184,257	$188,560	$188,560	$196,391	$+ 7,831
Chemical Sciences					
Operating Expenses..........	78,592	78,123	78,123	86,419	+ 8,296
Capital Equipment...........	8,840	8,506	8,506	9,555	+ 1,049
Construction................	5,550	5,609	5,609	5,430	- 179
Subtotal..................	92,982	92,238	92,238	101,404	+ 9,166
Nuclear Sciences					
Operating Expenses..........	39,641	41,445	41,445	46,913	+ 5,468
Capital Equipment...........	2,950	2,457	2,457	2,930	+ 473
Construction................	300	1,251	1,251	150	- 1,101
Subtotal..................	42,891	45,153	45,153	49,993	+ 4,840
Applied Mathematical Sciences					
Operating Expenses..........	34,467	37,925	37,925	32,785	- 5,140
Capital Equipment...........	1,500	1,030	1,030	1,100	+ 70
Construction................	0	4,811	4,811	0	- 4,811
Subtotal..................	35,967	43,766	43,766	33,885	- 9,881
Engineering and Geosciences					
Operating Expenses..........	26,085	25,571	25,571	29,412	+ 3,841
Capital Equipment...........	1,500	1,443	1,443	1,750	+ 307
Construction................	0	7,698	7,698	0	- 7,698
Subtotal..................	27,585	34,712	34,712	31,162	- 3,550
Advanced Energy Projects					
Operating Expenses..........	10,048	7,286	7,286	8,932	+ 1,646
Capital Equipment...........	320	308	308	330	+ 22
Subtotal..................	10,368	7,594	7,594	9,262	+ 1,668
Biological Energy Research					
Operating Expenses..........	12,360	11,960	11,960	14,538	+ 2,578
Capital Equipment...........	560	515	515	610	+ 95
Construction................	0	5,773	5,773	0	- 5,773
Subtotal..................	12,920	18,248	18,248	15,148	- 3,100
Program Direction					
Operating Expenses..........	3,830	3,499	3,499	4,125	+ 626
Subtotal..................	3,830	3,499	3,499	4,125	+ 626

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
Total					
Operating Expenses.......	$337,250	$340,057	$340,057	$380,055	$+39,998
Capital Equipment........	31,120	26,238	26,238	31,775	+ 5,537
Construction.............	42,430	67,475	67,475	29,540	-37,935
Basic Energy Sciences......	$410,800 a/b/c/	$433,770 c/d/e/	$433,770 c/d/	$441,370 c/	$+ 7,600
Staffing Total FTE's.......	63	69	63	63	

Authorization: Section 209, P. L. 95-91

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a/ Total does not include $3,350,000 transferred to SBIR program.

b/ FY 1985 total reflects a reduction of $2,940,000 for ADP general reduction.

c/ Totals reflect a reduction of $11,655,000 in FY 1985, $10,110,000 in FY 1986, and $11,000,000 in FY 1987 for management initiative savings.

d/ Total reduced by $17,041,000 in accordance with P.L. 99-177, the Balanced Budget and Emergency Deficit Control Act of 1985 (Gramm/Rudman/Hollings).

e/ A deferral of $38,489,000 is being proposed.

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer.	General Reduction	Management Initiatives	FTE General Reduction	Gramm-Rudman-Hollings	Subtotal	Comparability Adjustments	Adjusted Approp. Total
Basic Energy Sciences								
Material Sciences								
Operating Expenses	$140,496		$ -975		$ -5,273	$134,248		$134,248
Capital Equipment	12,450		--		-471	11,979		11,979
Construction	43,995		--		-1,662	42,333		42,333
Subtotal	196,941		-975		-7,406	188,560		188,560
Chemical Sciences								
Operating Expenses	81,495		-305		-3,067	78,123		78,123
Capital Equipment	8,840		--		-334	8,506		8,506
Construction	5,830		--		-221	5,609		5,609
Subtotal	96,165		-305		-3,622	92,238		92,238
Nuclear Sciences								
Operating Expenses	43,338		-265		-1,628	41,445		41,445
Capital Equipment	2,754		-200		-97	2,457		2,457
Construction	1,300		--		-49	1,251		1,251
Subtotal	47,392		-465		-1,774	45,153		45,153
Applied Mathematical Sciences								
Operating Expenses	39,520		-105		-1,490	37,925		37,925
Capital Equipment	1,070		--		-40	1,030		1,030
Construction....................	5,000		--		-189	4,811		4,811
Subtotal	45,590		-105		-1,719	43,766		43,766
Engineering and Geosciences								
Operating Expenses	26,675		-100		-1,004	25,571		25,571
Capital Equipment	1,500		--		-57	1,443		1,443
Construction....................	8,000		--		-302	7,698		7,698
Subtotal	36,175		-100		-1,363	34,712		34,712
Advanced Energy Projects								
Operating Expenses	7,602		-30		-286	7,286		7,286
Capital Equipment	320		--		-12	308		308
Subtotal	7,922		-30		-298	7,594		7,594
Biological Energy Research								
Operating Expenses	12,455		-25		-470	11,960		11,960
Capital Equipment	560		-25		-20	515		515
Construction....................	6,000		--		-227	5,773		5,773
Subtotal	19,015		-50		-717	18,248		18,248
Program Direction								
Operating Expenses	4,100	-335	--	-124	-142	3,499		3,499
Subtotal, Basic Energy Sciences	$453,300	$ -335	$ -2,030	$ -124	$-17,041	$433,770		$433,770

	FY 1986 Confer.	General Reduction	Management Initiatives	FTE General Reduction	Gramm-Rudman-Hollings	Subtotal	Comparability Adjustments	Adjusted Approp. Total
General Reduction:								
Operating Expenses	-335	335						
Capital Equipment	--	--						
Construction	--	--						
Total, General Reductions	-335	335						
Management Initiatives:								
Operating Expenses	-1,805		1,805					
Capital Equipment	-225		225					
Construction	--		--					
Total, Management Initiatives	-2,030		2,030					
Pay Restoration								
Total, Basic Energy Sciences..	$450,935	$ --	$ --	$ -124	$-17,041	$433,770		$433,770
Operating Expenses	353,541			-124	-13,360	340,057		340,057
Capital Equipment	27,269				1,031	26,238		26,238
Construction	70,125				-2,650	67,475		67,475

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST

SUMMARY OF CHANGES
Basic Energy Sciences
(dollars in thousands)

1986 Appropriation enacted	$450,811
1986 Gramm-Rudman reduction	- 17,041
1986 adjusted	433,770
Program increases and decreases:	
- Maintains the key elements of the research efforts underway. New research must come at the expense of ongoing programs	+25,994
- Essential facility support continued (i.e., safeguards and security, electric power, inventories, etc.); facility demand will continue to exceed capability	+ 8,504
- Research and development funding provided in support of the next generation of facilities needed to continue U.S. leadership in key scientific areas	+ 5,500
- Permits principal capital equipment commitments for normal replacements and facility requirements	+ 5,537
- Provides construction funding for ongoing projects nearing completion and for architect engineering and long-lead procurement for the 1-2 GeV Synchrotron Radiation Source	-37,935
1987 budget request	$441,370

Overview

For FY 1987, the request for the Basic Energy Sciences (BES) program is $441,370,000: $380,055,000 in operating funds, $31,775,000 in equipment funds, and $29,540,000 in construction funds.

Support for long range basic research is an important responsibility of the Federal Government. The extent of private sector activity in this domain has been limited mainly to a few large corporations with sufficient breadth and ability to support the facilities and infrastructure peculiar to basic research. The private sector activity, however, has been declining while industry is, at the same time, turning more and more to Federal laboratories and universities as sources of new ideas. Thus the BES program, a primary source of Federal funding for basic research, is finding a new and dynamic role in the conduct of R&D in the U.S. today. This role includes continuing the design and construction of expensive, unique major research facilities and support of their operations. National security, U.S. leadership in science and technology, and training technical manpower all are effectively served by a continuing vigorous basic research activity.

New technologies and improvements in existing technologies result from the innovative application of new scientific knowledge and concepts. It is crucial for the U.S. to maintain its scientific base; this requires continued funding of basic research serving the different energy supply and conservation options as well as U.S. science in general. It has become increasingly important for the U.S. to disseminate research results to the private sector and to participate in the effective exploitation of these results to benefit the U.S. economy. In FY 1984, for example, a major new materials initiative was started that not only attempts to deal with advanced materials research, but also with more effective communications and interactions with U.S. industry and training new researchers.

Basic Energy Sciences has a heavy involvement in large scientific facilities (e.g., the High Flux Beam Reactor and National Synchrotron Light Source at Brookhaven National Laboratory, the Combustion Research Facility at Sandia-Livermore, the High Flux Isotope Reactor and the Oak Ridge Electron Linear Accelerator at Oak Ridge National Laboratory, and high voltage and atomic resolution microscopes at several sites). Many areas of modern science require large and costly facilities; without them, the necessary advanced research could not be done. The large, expensive, unique facilities in the BES program are made available to the entire U.S. scientific community to the extent that funds permit. BES also is providing advanced state-of-the-art computational support for several Energy Research programs other than Magnetic Fusion Energy (which is directly supported by the National Magnetic Fusion Energy Computer Center (NMFECC)): High Energy and Nuclear Physics, and Biological and Environmental Research. Computational support, provided through the Applied Mathematical Sciences subprogram relies on an enhanced class VI computer system installed during FY 1985 at Lawrence Livermore National Laboratory; it is accessible through a nationwide data communications network funded jointly with Magnetic Fusion Energy.

The BES research program includes over 1200 projects; more than half of them are funded at the national laboratories. The remainder is carried out at universities and business and government laboratories. The research supported is selected on the bases of scientific merit, potential for increasing our technological base, and relevance to ultimately meeting the nation's diverse needs for energy. To carry out this program, BES plans, supports and administers energy related research in the physical, biological, mathematical and engineering sciences. New scientific information in these areas addresses the Administration's goals by providing the fundamental scientific and engineering base on which the Nation's future energy options depend. The strategy continues to be to:

Provide critical knowledge and data by supporting basic research in DOE mission areas;

Provide for, and support operation of, unique, specialized research facilities;

Exchange information with other DOE programs, Federal agencies, and the academic and industrial scientific communities;

Take full advantage of the scientific and industrial communities' identification of needs and opportunities for research in areas likely to be relevant to future energy options; and

Develop trained scientific talent through support of basic research at universities and national laboratories; and

Promote early applications of the results of basic research.

Implementation of this strategy requires:

Maintenance of a strong core program -- this calls for continuity of support for scientists involved in our current program activities, and the training of new, younger scientists;

Continued operation of existing, unique facilities important to research in the U.S. while at the same time providing for new facilities and for their operation; and

Creation of opportunities for exploiting new, emerging areas that are of potential importance to energy.

The program support provided to national laboratories can be divided into two major categories. A large portion is associated with support of national user facilities for which access is provided to the entire scientific community. The national laboratory serves as the host organization and selects and arranges for visitor participation, provides necessary specialized equipment and staff, administers all activities necessary to keep the facility operating, and performs necessary facility research and improvements necessary to continue its operation at the forefront of science.

The second major component of the national laboratory program is the support of research which takes advantage of the unique environment which exists at these institutions. By the very nature of the national laboratories and their traditional focus, the national laboratories are especially valuable in doing research which is applicable to a number of energy concepts. The interactions possible are very great because laboratory scientists are frequently involved in all aspects of the applied energy programs. In addition, the stability of the organization and specialized capabilities which exist at the laboratories in many instances are unmatched. As an example, the unique computer capabilities at the national laboratories are among the best in the world. The same can be said for neutron research capabilities at ORNL, ANL, and BNL. The programs supported at the laboratories are designed to exploit these unique capabilities, and programs are supported for which a long-range commitment must be made to achieve the desired results.

Many of the scientists involved in BES research programs are faculty or students at universities. Their research is enhanced through access to special facilities at national laboratories. More than one-third of BES funding supports university-based research. The list of universities receiving support covers almost every state and includes participation by both large and small institutions.

The BES program supports numerous special grants and research contracts in which costs are shared by universities. Their contributions are provided through a number of mechanisms, e.g., salaries to investigators, summer student assignments, provision of facilities and/or equipment, etc. An important benefit resulting from supporting research in universities is the research training of graduate students who continue in R&D after completion of their studies.

In addition to universities and national laboratories, BES maintains ties with industry. Representatives from different industries serve on counseling committees for several of the BES subprograms; experts from industry participate in the review of research proposals and use the specialized facilities sponsored by BES; industrial scientists participate in program advisory committees at the national laboratories; and industry representatives are invited to attend BES conferences and workshops on special topics. Through these and other mechanisms available to, and used by, the scientific community, the results of BES supported research are available to industry and to the academic community.

The U.S. has been the world leader in science and technology and has derived many economic benefits from its leadership. The Department of Energy and its multiprogram laboratories play an important role in the nation's scientific enterprise that is essential for our preeminence. A central feature of this role has been the construction and operation of large, specialized scientific facilities that are used by scientists from universities and industry as well as the national laboratories. Many of the scientific facilities in our multiprogram laboratories are old or are becoming old and their scientific productivity will soon become marginal. In order to make further progress in certain fields, new, more powerful facilities are required.

In the past few years, the Department has given special attention to correcting deficiencies at its laboratories in environment, health, safety, security, safeguards, multiprogram general purpose facilities and other such areas. However, less attention has been paid to improving the essential scientific facilities required to accomplish the main scientific mission of the laboratories, i.e. preeminence in certain key fields of research. Four facilities have been identified by the scientific community as being the most critical to the future needs of the Department's basic research programs. The four facilities, all of which will be located at the Department's multiprogram laboratories, are: 1-2 GeV Synchrotron Radiation Source - Lawrence Berkeley Laboratory; 6 GeV Synchrotron Radiation Source - Argonne National Laboratory; Advanced Steady State Research Reactor - Oak Ridge National Laboratory; and Relativistic Heavy Ion Collider - Brookhaven National Laboratory. This latter facility is budgeted in the Nuclear Physics Program. The FY 1987 request includes a start toward development of these facilities for the Nation.

	FY 1985	FY 1986	FY 1987 Request
Materials Sciences			
Operating Expenses......................	$132,227	$134,248	$156,931
Capital Equipment.......................	15,450	11,979	15,500
Construction............................	36,580	42,333	23,960
Total Materials Sciences..............	$184,257	$188,560	$196,391

The Materials Sciences subprogram has as its goal to provide the Agency and the Nation with an increased level of understanding in the science of materials, which will contribute to meeting the needs of present and future energy technologies. Knowledge or lack of knowledge in materials science and technology plays a crucial role in the development of energy systems or other high technology industries. The field of materials science is important because it pushes forward the frontiers of knowledge and trains new scientists in subjects which are highly interactive with industrial topics. Materials problems and limitations often restrict the performance of current energy systems and the development of future systems. A few examples of such problems and limitations include: degradation of mirror materials and low conversion efficiency photovoltaic materials for solar energy; degradation of materials properties due to irradiation in fission and fusion energy systems; thermal and mechanical instabilities of materials for heat engines; and corrosion and compatible materials for containing nuclear waste.

Many studies and reviews in recent years have pointed to both the importance of the field of materials science and to the opportunities and high quality of the research. Most notably these studies have been conducted by the National Academy of Sciences and the Energy Research Advisory Board. The Congress has also expressed great interest in materials research and this past year sponsored a workshop on the subject. In all of these studies and reviews, the Materials Sciences subprogram has played a key national role.

While each Federal agency conducts materials research to meet its own particular objectives, coordination across agencies is readily accomplished through established committees and interactions. In the area of basic materials research, the Materials Sciences subprogram coordinates its research most directly with the National Science Foundation's (NSF) Materials Research Division and the more basic programs of the Department of Defense. The unique aspect of the Materials Sciences subprogram is the focus on energy related research and the use of advanced diagnostic techniques made possible by state-of-the-art research facilities supported by this subprogram. These activities complement the NSF and other agency programs and are needed to carry out the mission of the DOE. As an example of how the DOE programs complement the work at other agencies, the DOE program is very significant in radiation effects, corrosion-erosion related to fossil energy systems, solar photovoltaic materials, or nuclear waste isolation materials, whereas the NSF program tends to be much more generic and tends to focus almost exclusively on small-scale science with limited involvement of major facilities. The Materials Sciences subprogram also has large efforts in facility-related research such as neutron scattering, synchrotron radiation research, and electron microscopy, compared to the relatively small efforts in the NSF program.

The Materials Sciences subprogram has traditionally provided most of the development, construction, and operational support of large facilities for the total national materials program. Use of these major facilities is open to all qualified researchers. A recent survey of these collaborative research centers under the purview of the Materials Sciences subprogram has shown that they accommodated about 1100 users. The users came from DOE laboratories (21 percent), universities (48 percent), industry (14 percent), and the remainder from other organizations. The replacement cost for these facilities is estimated at over $500,000,000. The Materials Sciences research funding at these facilities in FY 1985 was about $20,000,000 with another $14,000,000 being attracted from outside the Materials Sciences subprogram.

The FY 1987 request includes the following amounts for the Materials Sciences subprogram: $156,931,000 in operating funds which provides support for the operation of facilities and research of all types; $15,500,000 in capital equipment in support of the research objectives and $23,960,000 in construction which will permit continuation and/or completion of ongoing projects at Lawrence Berkeley Laboratory (LBL) (Center for Advanced Materials); Brookhaven National Laboratory (BNL) (National Synchrotron Light Source); and Stanford University (Stanford Synchrotron Radiation Laboratory); A-E and long lead procurement activities for the 1-2 GeV Synchrotron Radiation Source at Lawrence Berkeley Laboratory; initiation of a new construction project, the Los Alamos Neutron Scattering Experimental Hall, plus funds for Accelerator and Reactor Improvements and Modifications.

The opportunities available to the field of materials science continue to outpace the resources. New methods for characterizing materials and new materials structures are being uncovered. As a result, the time is right to exploit these opportunities and make the advances needed to solve outstanding scientific questions and technological problems. Coupling the experimental and theoretical advances with improved ability to prepare new materials will open up opportunities to design materials from fundamental principles and overcome or circumvent known and anticipated energy related materials problems.

Some of the problem areas and needs to which the Materials Science research ultimately contributes include:

- Developing new or substitute materials
- Tailoring materials to satisfy defined requirements
- Predicting materials problems and service life
- Improving the ability to successfully attack unforeseen materials problems in advanced energy systems, and
- Improving the theoretical and experimental capability to analyze the fundamental structure of materials

To uncover the new knowledge and information to meet these needs, Materials Sciences, comprised of the subfields of metallurgy, ceramics, solid state physics, and materials chemistry, places emphasis on selected generic areas of fundamental importance and on areas where problems are known to exist or are anticipated. Some research is directed at a single energy technology (e.g., photovoltaic materials for solar energy conversion), some research would have applicability to many technologies simultaneously (e.g., embrittlement of structural materials due to the presence of hydrogen), and still other research has more fundamental implications underpinning all materials research (e.g., mechanisms of atomic transport of solids). The research is conducted among a variety of institutions--national laboratories, universities, and to a lesser extent, industry.

In addition to maintaining an appropriate mix among long-term sciences, multitechnology and single energy technology oriented research, a balance must be achieved between research at forefront large facilities and research consisting of small individual projects. Certain types of research simply cannot be carried out without large facilities (e.g., neutron sources with significant fluxes of neutrons cannot be made in "small" sizes). Also newer instruments with significant improvement in capability (e.g., synchrotron radiation sources) are very expensive to build and operate. The Materials Sciences subprogram utilizes several major user facilities in the pursuit of its research goals, including the National Synchrotron Light Source (NSLS) BNL, High Flux Isotope Reactor (HFIR) Oak Ridge National Laboratory (ORNL), Intense Pulsed Neutron Source (IPNS) Argonne National Laboratory (ANL), Neutron Scattering Experimental Hall, Los Alamos Neutron Scattering Center (LANSCE), and the Stanford Synchrotron Radiation Laboratory (SSRL). Other smaller research centers include the Low Temperature Neutron Irradiation Facility (LTNIF) ORNL, Surface Modification and Characterization Laboratory (SMCL) ORNL, Electron Microscope centers at ORNL, ANL, LBL, and the University of Illinois and the Materials Preparation Center (MPC) at Ames Laboratory. These facilities are also available to qualified users outside the home institution.

The subprogram utilizes workshops and reports of its Council on Materials Science (a non-Governmental body with representatives from academia, industry, and agency laboratories) to help focus on critical issues. Panel meetings during 1984 were held on computer simulation and materials synthesis. In 1985, panel meetings were held on microfracture and surface adhesion/bonding. The reports resulting from these workshops and panels are distributed widely, including publication in the open literature. Through the auspices of the Council, a review of user facility operations has started with the electron microscope facilities in 1985.

Reviews of the neutron sources and synchrotron radiation sources will follow. Interactions and information transfer with the agency's applied materials research takes place through a number of mechanisms including a formalized Research Assistance Task Force. Examples of these latter activities include meetings on fast ion conductors and corrosion in fossil energy systems. Through these latter meetings the basic researchers learn of the problems in the applied programs and the researchers in technology oriented programs are exposed to scientists with a fundamental understanding of matter. Coordination among the Department's materials programs takes place primarily through the Energy Materials Coordinating Committee. Within the Federal Government, the subprogram is coordinated in part through the interagency Committee on Materials (COMAT) and the basic Interagency Materials Group. At the Federal program level, Materials Sciences continues to represent about one-third of the Federal government support for basic materials research.

Both directly and indirectly this subprogram supports the development of a national position on materials research. The ability to provide such support stems directly from the experience and continuity within the Materials Sciences subprogram. The fundamental understanding of materials obtained in this subprogram has led to new approaches to alloy design for critical materials substitution, new materials with superior properties and advanced characterization techniques. Materials Sciences is recognized throughout the research community for its excellence. Past technical accomplishments have moved into the technological or commercial sector (e.g., radiation resistant alloys, glassy metals, ion implantation techniques for surface modification, and superconducting wire), and it is expected that through the proven method of technology/information transfer and effective management this year's accomplishments will likewise find use either for building our fundamental base of materials understanding or in some technological application in the future. Industrial interactions with this subprogram are encouraged and indeed have been successful. The large number of patents issued under this subprogram is further evidence of the strong and appropriate technological orientation. Significant progress was made during the past year in many areas of the subprogram. Some examples of recent accomplishments include:

- For the first time, magnetic ordering (arrangement of the magnetic moments of individual items in materials) has been measured using X-rays. Magnetic ordering of the rare earth metal holmium has been measured using X-rays at the world's most intense X-ray beam line at SSRL. The magnetic scattering peak position shows an oscillation that is temperature dependent indicating an oscillation in the spiral magnetic ordering. This is the first conclusive magnetic X-ray scattering measurement made and reveals additional new capabilities for intense synchrotron radiation sources.
- The highest superconducting transition temperature (5K) has been found for an organic compound at ambient pressure. This development opens the possibility of radically new conducting organic materials which could revolutionize electrical systems.
- An automated synthesis technique has been developed that enables the preparation of low cost magnetostrictive alloys (changes in the dimensions of materials due to applied magnetic fields). The technique yields grain oriented rare earth-iron magnetostrictive (Tb-Dy-Fe) material with circular, square and hexagonal cross sections useful for transducer components and single crystals with selected axial crystallographic orientation. With this new technique, the cost of such components may be reduced by 50-75 percent. These materials will enable significant improvements to be made in the performance of transducers in jet and diesel engine fuel injection systems, submarine detection devices, and position detecting transducers in robotic systems as a consequence of the increased magnetostriction obtained in this alloy produced by this new synthesis technique.
- For the first time, a detailed characterization of cavity evolution during the compressive creep deformation of ceramic materials has been determined. Using neutron scattering measurements, it has been shown that cavity nucleation does occur, usually throughout the service lifetime prior to fracture, and that the cavity growth is transient and quickly reaches a size of about 100 nanometers. These statistical data can not be obtained by any other method and are needed in order to improve the performance and predict the service lifetimes of structural ceramic components envisaged in the next generation of energy conserving heat engines.

Within the FY 1987 request current emphases and trends in the subprogram will be continued and extended with no significant change. Because of the opportunities and increased demand to utilize major user facilities, the operations together with research at these facilities will increase. At the FY 1987 request, research will be strengthened in selected technical areas at the expense of other ongoing projects. The university portion of the program not located at DOE laboratories will be maintained at about 20 percent. When including Ames Laboratory (Iowa State University) and Lawrence Berkeley Laboratory (University of California), which are similar to other academic programs, the support going to universities is scheduled to be about 36 percent. Areas identified for emphasis generally fall into two categories of objectives: 1) synthesis, alloying, and preparation of new materials and structures; or 2) materials characterization and property measurements using highly advanced techniques. In consonance with the subprogram's long range plans published last year, the relative emphasis will be on category 1) areas where possible, recognizing of course that the two categories need to be coupled. Research areas to be emphasized include:

processing and mechanical behavior of structural ceramics; structure and properties of polymers; unique calculations, properties and measurements on surfaces, interfaces, and modified surfaces; high flux pulsed neutron scattering research; X-ray lithography, topography, and surface structural measurements using synchrotron radiation; use of high speed computers to calculate and simulate materials phenomena; and electron microscopy and property measurements on advanced materials such as high temperature, ordered, intermetallic compounds, nonequilibrium materials and atomically layered structures. As mentioned above, the limited resources available requires that most of the new emphases be undertaken at the expense of lower priority but still productive activities.

The FY 1987 request for the Materials Sciences subprogram will provide for needed continuity and permit a reasonable level of utilization of major facilities, and strengthening of important topical areas recommended by workshops, panels of the Council on Materials Science and National Academy of Sciences reports. The operating funds of $156,931,000 include part of the needed $10,000,000 for optimum facility operations. This includes added requirements at HFBR for safeguards and security, the first full year of operation of the Los Alamos Neutron Scattering Center (LANSCE) and the full operation of NSLS now that the X-ray ring is operational. Selective decreases will be made to the operating schedule of some small facilities. At the FY 1987 request all user facilities will continue to operate. About one third of the operating increase allowed will be earmarked for research and one third for facility operations and one third for research and development of advanced facilities. Selective decreases will also take place in the research programs to accommodate some specific strengthening and cost-of-living increases. This level for the capital equipment portion of the budget will be used to replace outmoded equipment and allow for some new avenues of research, new spectrometers at neutron sources and new beam lines at synchrotron radiation facilities. This capital equipment level will permit the subprogram to adequately equip the research programs moving into vitally important new areas such as semiconductor materials preparation, ceramics processing and the exploration of new high-strength or high-conductivity polymers. Funds in the amount of $300,000 are included for partial support of Atmospheric Release Advisory Capability operations managed by the Assistant Secretary for Environment, Safety, and Health.

The FY 1987 request for Materials Sciences for construction will permit completion or continuation of FY 1986 approved projects and a start on two new projects. At the Stanford Synchrotron Radiation Laboratory (SSRL), funds of $1,717,000 are requested in FY 1987 to complete the SSRL enhancement project consisting of improvements and a small laboratory addition to SSRL totaling $12,930,000. At Brookhaven National Laboratory, funds of $2,600,000 in FY 1987 are requested to complete the National Synchrotron Light Source (NSLS) beam lines and building expansion project totaling $19,700,000. At Lawrence Berkeley Laboratory, funds are requested in FY 1987 for continuation of the project, Center for Advanced Materials, consisting of two buildings--a Surface Science and Catalysis Laboratory and an Advanced Materials Laboratory. This request is for $10,560,000 of a total project cost of $40,250,000. At Los Alamos, FY 1987 funds of $5,000,000 are requested to initiate construction of the Neutron Scattering Experimental Hall, which has a TEC of $17,500,000. Accelerator and Reactor Improvements and Modifications (ARIM) funds of $2,583,000 are also requested for the existing facilities at BNL (HFBR and the NSLS) and the Ames Laboratory. Further details for each of the construction projects are provided in the attached construction data sheets.

Included in the program described above are funds for new scientific facilities research and development to better define technical parameters and define project costs. The United States has been the world leader in science and technology with the Department of Energy playing a crucial role through the innovation, development, construction, and operation of accelerator-based or reactor-based specialized scientific/engineering facilities. These unique facilities are used by scientists from universities and industry as well as the national laboratories.

The Department proposes to begin the process of providing the technical community with new more powerful facilities to advance the state of technology and the competitive position of the United States in these areas. Two of the highest priority BES-related facilities proposed are: 1-2 GeV Synchrotron Radiation Source (LBL), and continued research and development on the 6 GeV Synchrotron Radiation Source (ANL). The concept and need for these facilities have been reviewed and recommended by several committees, most notably and recently the National Research Council (NRC) study of Major Materials Facilities and the DOE Energy Research Advisory Board review of the NRC report. Since significant research has been conducted in the past, the 1-2 GeV facility is being proposed for construction by requesting architect-engineer and long-lead procurement work in FY 1987. Research and development for the 6 GeV facility will be continued to prepare for a future decision regarding construction at ANL.

The 1-2 GeV Synchrotron Radiation Source (LBL, TEC - $90-100M) consists of a storage ring with many straight sections for magnetic devices which produce high intensity vacuum ultraviolet radiation. The complement of magnetic devices will provide 30 or more experimental stations with radiation of high brilliance and very low emittance. The injection and accelerating system for the storage ring provides the circulating particles with energies in the 1-2 GeV range.

This facility will provide intense photon beams with the ability to undertake very short-lived timing experiments. This facility, which would have the highest brightness and lowest emittance in the world in this energy range, would be used primarily for surface investigations and spectroscopy important to physics, materials, chemistry, biology and several commercially significant technologies. The picosecond timing also makes it possible to study processes and materials that occur over periods as short as 10^{-11} seconds. The beam brilliance would allow entirely new studies of dense plasmas and absorption by highly-ionized atomic species. Microlithography techniques would be explored for the efficient production of electronic devices and soft X-ray microscopy and holographic techniques would be developed with high spatial resolution for the diagnosis of biological specimens. Other experiments important to national security needs would also be undertaken. Funding for A-E and long-lead procurement is requested ($1,500,000 construction) in FY 1987 in order to refine the costs, schedule and design in preparation for construction. FY 1987 funding ($1,500,000 operating and $500,000 capital equipment) for research and development activities related to a final storage ring lattice design would also include investigations of RF, beam instrumentation and control and new vacuum systems that are needed for peak performance characteristics. The intense photon beams which would be employed would require radiation-hardening studies of several components of the beamline complex.

The 6 GeV Synchrotron Radiation Source (ANL) as currently envisaged would consist of a large storage ring containing as many as 30 magnetic devices to give intense hard X-rays. The injection and booster systems would be designed to inject positrons into the storage ring at the design energy of 6 GeV. Beam currents as high as 100 milliamperes and lifetimes of at least 10 hours are anticipated. Most importantly, the lowest possible beam emittance would be sought to give the highest brilliance X-ray source strength by a factor of 10,000 over any in existence. This facility would impact heavily on the fields of physics, materials, chemistry, biology and medicine, and many technologies. Determination of bulk and surface structure will be performed with greater resolution and accuracy. Observation of catalytic activity in Materials with less than 1/10 of an atomic layer will be possible. Microprobe characterization will allow impurity detection in the parts per billion range, and inelastic X-ray scattering, an unexplored field, will be possible. Investigating time-dependent phenomena in biological membranes and in photocyclic processes will be possible as will observing the motion of atoms in proteins. Angiography of coronary and tumor diseases will be advanced through non-invasive and very fast X-ray diagnostics without the use of dyes or drugs. Topography, the study of surface imperfections, will be extended to time-resolved studies of plastic deformation and fracture. All of these investigations are made possible by the photon energy, time-structure, intensity, and unusual brilliance of the radiation source. Other experiments important to national security needs would also be undertaken.

FY 1987 ($2,000,000 operating and $1,000,000 capital equipment) research and development funding will be used to refine the lattice design of the storage ring, design and test new radio frequency cavity systems, advance vacuum technology and surface cleaning techniques, and investigate beamline components that must withstand greater X-ray intensities than have been previously achieved.

	FY 1985	FY 1986	FY 1987 Request
Chemical Sciences			
Operating Expenses......................	$ 78,592	$ 78,123	$ 86,419
Capital Equipment.......................	8,840	8,506	9,555
Construction............................	5,550	5,609	5,430
Total Chemical Sciences..............	$ 92,982	$ 92,238	$101,404

The purpose of the Chemical Sciences subprogram is to expand the knowledge base of chemistry and atomic physics on which future energy technologies depend. In the foreseeable mix of energy systems, most of the technologies will depend on processes which are chemical, or based on atomic physics. Our future energy supply depends on present strong support of research seeking knowledge in fields which are basic to energy processes.

Recently a panel of the National Academy of Sciences/National Research Council, as well as the American Chemical Society, senior academic scientists, and senior industry scientists have advocated increased funding for chemical research. They have pointed to the importance of chemistry in our energy economy and to the potential losses from the current limited level of research. The Energy Research Advisory Board, in its recent appraisal of the DOE Technology Base, placed Chemical Sciences in the top grouping of subprograms recommended for increased funding.

The Chemical Sciences subprogram spans a broad front, but emphasizes eight areas because of their importance to energy technologies. The areas are: photoconversion (light energy to fuel energy or electricity), chemical physics (including basic chemistry of combustion), atomic physics (a subfield important to magnetic fusion), basics of coal chemistry, heterogeneous and homogeneous catalysis (especially that underlying coal conversion and more efficient processing of petrochemicals), separations and analytical science (underlying virtually every facet of process chemistry) and chemical thermodynamics (the chemical basis for predicting the optimal handling of hydrocarbon mixtures).

Photochemists are moving closer to a full understanding of photosynthesis, an understanding necessary if we are to imitate and improve on nature's efficiency in forming fuels from airborne gases. They are also building the knowledge base which may enable us to produce hydrogen from water at a reasonable cost.

In-depth understanding of combustion is important to the use of lower grade fuels and to continued progress in improvement of the efficiency of engines, especially automotive engines.

Researchers in atomic physics are making steady progress in enlarging our knowledge of the behavior of the highly stripped ions which can seriously lower the efficiency of fusion reactions, thereby providing guidance as to choice of materials. The behavior of ions at energies higher than fusion energies is also being examined.

Scientists supported by Chemical Sciences are studying the molecular structures of coals and the chemical reactivities of the coal constituents in order to give coal technologists better bases for improving existing coal processes and for developing new and better concepts for obtaining synfuels from coal. Premium quality samples of coals, standardized and preserved, are being provided to the research community for comparability of research done at different times and places.

Just as catalysis is used today in production of billions of dollars' worth of fuels, plastics, etc., it is reasonable to expect that, given in-depth understanding, catalysts can be designed for production of tomorrow's fuels. Those Chemical Sciences researchers engaged in catalysis research are making steady progress toward that goal of full understanding.

Many separation processes often require special extractants to remove selected constituents from process or waste streams. Such separations require both theoretical and experimental understanding to design and synthesize these extractants. Some separation processes, such as distillation of petroleum or synfuel fractions, consume large amounts of energy. New knowledge and insights can help improve existing processes, and can help create entirely new concepts which are less energy intensive. Conceptual neighbors of separations chemists are the analytical chemists who are generating basic, widely applicable approaches to analysis. It is important, in many processes which make fuels or consume energy for other purposes, to identify and quantify impurities which can spoil a product, poison a catalyst or prevent the desired chemical processes.

Chemical thermodynamic studies are being pursued in order to strengthen the knowledge needed to design major plants for producing or handling hydrocarbon fuels. Many fuel mixtures currently or potentially important are not covered by currently available data. Measuring every mixture of interest would be too costly, so thermodynamical research on a sound theoretical basis is providing the needed calculational predictive capabilities.

Two major user facilities receive support through Chemical Sciences. Both facilities were constructed by Basic Energy Sciences for use of scientists in DOE programs and qualified visiting researchers. The Combustion Research Facility (CRF) at the Sandia National Laboratories (Livermore) receives its entire facility operating support from Chemical Sciences, which also provides a major part of the user research support. The National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory receives facility operating and research support from both Chemical Sciences and Materials Sciences.

The operation of the CRF facility includes continued improvement of its unique state-of-the-art laser systems and providing laboratory space, equipment and advisory assistance to visiting users. The automobile industry is prominent among the users; its leaders have stated that CRF is the first Federal research laboratory to attract that industry. CRF research involves inventing, developing and using advanced diagnostic techniques to provide such key information as identities and quantities of very short-lived flame constituents, profiles of temperatures in flames and modeling of turbulence. These are important kinds of information needed for improvements to combustion systems.

Details on the operation of the NSLS are set forth in the Materials Sciences part of this document. The areas of research supported at NSLS by Chemical Sciences are chosen for their combination of scientific insights and importance to chemical and atomic physics problems in energy technologies. Among them: photochemistry in the ultraviolet, electronic interactions between surfaces and adsorbed molecules, and photon excitation and ionization of atoms and molecules.

The Chemical Sciences effort is coordinated with other DOE programs involving chemistry and with other Federal agencies. Periodic meetings of the Federal Interagency Chemistry Representatives and exchanges of lists of proposals and funding actions supplement frequent individual contacts between staffs. Annual and biennial topical conferences bring together the researchers in specific areas of the subprogram with industrial scientists and others.

Typical advances in energy-related chemistry and atomic physics achieved this year by Chemical Sciences are:

- Styrene-based polymers with active phosphorus-containing groups have been discovered which efficiently and economically recover major or trace amounts of toxic or precious metals, e.g., mercury or gold, from waste streams, rivers or sea water. The new extractants are synthesized from inexpensive chemicals. They contrast with present systems which generally require more expensive materials or multiple separation steps to accomplish the same degree of recovery. They were devised through a collaborative university-national laboratory effort.

- A significant advance in the quest for an artificial photosynthetic system has been achieved by chemical synthesis of a model photoreaction center. A key feature of this system is that charge separation occurs following photoinitiated multiple electron transfers. This moves us closer to the goal of improving on natural photosynthesis by positioning of electron donor and acceptor components in the optimum geometry for high efficiency solar conversion.

- Recent results will make possible a new and detailed understanding of the effects of poisons and promoters in catalytic systems. Superior accuracy and resolution of infrared spectral bands, achieved by combining different state-of-the-art techniques for adsorbed species on single crystals in a multipurpose ultrahigh vacuum system, revealed that the frequency shifts caused by changing the amount of carbon monoxide adsorbed on a Ni(111) crystal surface are due to modification of the chemical properties of the nickel surface itself, caused by the adsorbed carbon monoxide.

- A study on the separation of coal at ANL has resulted in the development and implementation of a method for providing very pure coal components that is now being used in several other coal research laboratories. Further, the Premium Coal Sample Program at ANL has successfully processed and sealed samples of the first premium coal, to be available to scientists world wide for comparability of basic research results obtained at different times and places for many years. The availability of premium coal samples and pure coal macerals in quantity is fostering meaningful collaborative studies between ANL and both university and industrial laboratories.

- Laser-induced chemistry has found a new kind of molecular behavior. The absorption of light by a molecule, to introduce either large or small amounts of vibrational energy among its atoms, shows regular frequency spacings which fit quantum mechanical predictions. However, there is an intermediate, heretofore inaccessible energy region where increased vibrational energy does not follow this pattern, but may be randomly distributed. This random behavior has been observed for the first time in acetylene. One laser was used to excite the acetylene molecules to high vibrational states and a different laser then triggered energy emission to get down to the intermediate region.

The FY 1987 request for operating funds is $86,419,000. Within this, an increment will provide for operating costs of the two major user facilities (CRF wholly, NSLS partly), including assistance to visiting users, and research using their capabilities for the areas of chemistry described above.

Also included in the FY 1987 request is an increment to permit restoration in areas which have been identified as important to the knowledge base for energy technologies and which offer a high degree of scientific opportunity. One of these is chemical reactivity; this area includes study of chemical dynamics in the gas phase, which is basic to many energy systems, especially improved combustion technology. An important scientific tool, pulse radiolysis, will be brought to bear as a generator of the short-lived but important species which figure in combustion. Combined with it will be use of laser techniques such as coherent Raman spectroscopy and multiphoton ionization to characterize the species. Experts in chemical theory will provide direct and meaningful interaction with experimentalists, extending previous calculations of molecular and radical reactivities in species extending from these containing only two or three atoms to up to ten. Also studied will be reactive intermediates in condensed phases, since many chemical processes which form or convert fuels involve complex mixtures of substances undergoing chemical reactions, both desired and undesired, dispersed in solvents.

To understand the chemistry of such mixtures, effort will be directed toward understanding the individual reactions, their effects on each other and the effects of the solvent molecules. Prominent here will be study of the influence of solvent dielectrics on chemical kinetics and the relation of electronic structure to reactivity. Another aspect of the area of chemical reactivity will concern electron transfer in chemical systems. This will contribute especially to improved understanding of photosynthesis which could lead to a variety of new uses of sunlight to form fuels. Related to this will be study of the effects of the colloidal state on photoexcited electron transfer, an area likely to lead to qualitatively new knowledge.

Another area of emphasis is related to chemical catalysis. This area of the knowledge base is pervasive in energy technologies, and is at a stage likely to see scientific breakthroughs. Studies will be conducted to exploit a new and scientifically powerful technique recently pioneered in Chemical Sciences: laser-induced generation of small clusters of metal atoms of selectable size and of controllable combination with desired numbers of nonmetal atoms. The insights to be gained with this technique may lead to better understanding of various kinds of catalytic chemistry, including fuel conversions, as well as other energy-related chemical processes.

At Kansas State University the new Ion Collision Physics Facility will be nearing completion and the research activities will include stepped up preparation for its use. The cryogenic electron beam ion source (CRYEBIS), when operational, will not only strongly advance the efficiency and capabilities of scientific research on the behavior of multiply charged ions but will also greatly improve our ability to unravel the complexities of behavior of highly stripped, relatively slow moving metal ions, which must be understood in the design of magnetic fusion devices.

The remainder of the increase will allow for requirements which include the effects of inflation on research capability, and interagency activities such as panels of the National Research Council. The balance of the Chemical Sciences subprogram will continue the activities described earlier, with the evolving of scientific thrusts which has long characterized the subprogram.

The request for capital equipment funds is $9,555,000. The request includes General Purpose Equipment for ANL ($2,200,000) and the Ames Laboratory ($155,000). The principal other purpose for these capital equipment funds is to provide the advanced instruments which are revolutionizing chemical research. The measurements they allow promise to open knowledge even more meaningful than heretofore possible in areas important to energy technologies. Typical of these instruments are ultra-high field nuclear magnetic resonance spectrometers, advanced lasers, multiparameter molecular and ion beam machines, and Fourier Transform electron spin resonance spectrometers.

The request for construction funds is $5,430,000. The largest part of the need results from landlord responsibilities for sites for which BES has overall landlord responsibility: $3,000,000 for ANL, $600,000 for the Ames Laboratory, $300,000 for the Combustion Research Facility and $30,000 for the Notre Dame Radiation Laboratory. As shown above, the largest component of the request is for ANL, where there remains a heavy backlog of needs affecting plant efficiency following several years of extremely severe budget stringency. Details are shown in the attached construction data sheet (87-R-400).

Also included in the request is $1,200,000 to complete construction of the Ion Collision Physics Facility at Kansas State University. Initiated in FY 1985, this project has a total estimated cost of $5,100,000. It represents the United States' first atomic physics facility which is based on state-of-the-art ion accelerators and it will restore US competitiveness in the area of ion collision physics, an area of importance in science and energy. Details are described in the construction project data sheet 85-ER-403. The final part of the construction request is Accelerator Improvement and Modification funding of $300,000 which is needed in order to install two beam lines for atomic physics research at the Holifield Heavy Ion Research Facility, thus greatly enhancing the capability to perform research on highly charged ions.

	FY 1985	FY 1986	FY 1987 Request
Nuclear Sciences			
Operating Expenses......................	$ 39,641	$ 41,445	$ 46,913
Capital Equipment.......................	2,950	2,457	2,930
Construction............................	300	1,251	150
Total Nuclear Sciences................	$ 42,891	$ 45,153	$ 49,993

The Nuclear Sciences subprogram encompasses five principal activities: (1) advancing the knowledge and understanding of the heavy elements' chemical and physical behavior; (2) providing isotopically enriched samples of ordinary elements and samples of the man made transplutonium elements for research, medical, and industrial uses; (3) measuring, compiling, and evaluating nuclear data for both fission and fusion energy technologies; (4) operating the Stanford Synchrotron Radiation Laboratory for the broad community of synchrotron radiation researchers; and (5) conducting research on heavy ion accelerator technology and preparing for its evaluation as a driver for use in inertial confinement fusion systems.

The FY 1987 request for FY 1987 includes $46,913,000 for operating expenses, $2,930,000 for capital equipment, and $150,000 for construction.

Heavy Element Chemistry

Knowledge of the chemical, physical and nuclear properties of the manmade elements beyond plutonium is important to the management of nuclear materials, particularly in their chemical processing, and for medical, industrial or research applications. Also of importance is the information the heavy elements can provide to elucidate scientific theory on the chemical and physical properties of the natural elements. This research enhances that theoretical understanding because of the actinide elements' position near the limit of the periodic table. They are at the edge of the region where relativistic electrons may exist due to the exceedingly high electrical charges on their nuclei. The potential relevance of this phenomenon to their chemistry is completely unexplored.

Most heavy element research is conducted at DOE laboratories where adequate facilities exist to meet the requirements of health and safety in handling them. Some of the research is done through university research contracts or grants, often making use of DOE laboratory facilities and in collaboration with DOE laboratory scientists. Heavy Element Chemistry is a small but active field important as a source of expertise and trained people for future nuclear technologies in energy, medicine, the military and industry. The field's accomplishments are typified by these recent examples:

- Neptunium, a radioactive element in spent nuclear fuels, has long been considered a problem in underground storage because the chemical state preferred by neptunium when in ordinary ground water is mobile. Now it has been found that in some ground waters a different state of neptunium forms. That state much more readily binds chemically to soil constituents, immobilizing the neptunium.

- Results with unexpectedly wide impact have come from ultrahigh pressure studies of the crystal structures of transplutonium metals. Large collapses of volumes have shed new light on how certain electron states possessed only by the actinide elements bond their atoms together and bring about their physical, chemical and electronic properties. Changes will now be required in the theory of structure and bonding of many other chemical elements as well.

The FY 1987 request is $5,066,000 in operating funds. DOE provides essentially all the U.S. support for this field of science. The FY 1987 request for capital equipment is $361,000.

Isotope Preparations

U.S. capabilities for providing enriched isotopes in the quantities needed for clinical medicine, for biomedical and physical research and for industrial applications depend on three facilities at the Oak Ridge National Laboratory. These are the Electromagnetic Isotope Enrichment Facility (Calutrons), the High Flux Isotope Reactor (HFIR) and the Transuranium Processing Plant (TRU).

The Calutrons separate the various isotopes making up the naturally occurring elements. Samples are sold to researchers in biomedical, nuclear and other areas and to industrial suppliers of medical radioisotopes made by nuclear irradiation of the natural isotopes. In addition, a Research Materials Collection is maintained for use by nuclear physicists and other scientists, with the proviso that the samples are to be returned undamaged.

The HFIR has two purposes: producing research quantities of elements heavier than plutonium, and providing an exceptionally high flux of neutrons for studies of materials; it is one of the two principal U.S. facilities providing neutrons in continuous flux for such research. The research at HFIR is supported by the Materials Sciences subprogram of BES, the Magnetic Fusion Energy program, and the National Science Foundation.

The TRU chemically separates the desired higher elements produced in HFIR into pure form and returns the remaining target material for re-use. HFIR and TRU together are the only Western world source of californium-252, a widely used portable source of neutrons for medical, defense, industrial and scientific applications.

The FY 1987 request for Isotope Preparations is $18,077,000 in operating funds. The requested level is needed to maintain a minimal one segment operation of the calutrons. The rest of the increase is needed for the operation of the HFIR and the TRU for two purposes: maintenancd costs of cells and apparatus which have experienced exceptionally high levels of radiation and limited replacement staff who must be trained to learn operational and safety skills before retirement of staff experienced in this unique facility.

The capital equipment request for Isotope Preparations is $524,000.

Nuclear Data

The goal of the Nuclear Data activity is to establish and maintain an accurate, complete, and accessible nuclear data base to meet the long-term needs of the fission and fusion energy technologies, to support biomedical activities using radioactive materials, and to support nuclear waste management and weapons development activities of the Department. The request for FY 1987 is $11,117,000, which includes $10,442,000 for operating expenses and $675,000 for capital equipment.

The Nuclear Data activity includes the core functions of the National Nuclear Data Center (NNDC) at Brookhaven National Laboratory--compilation and encoding of neutron reaction data, coordination of the work of the Cross Section Evaluation Working Group, and maintenance of the Evaluated Nuclear Data File (ENDF). In FY 1987, priority will be given to efforts necessary for development of the next version of the Evaluated Nuclear Data File--Version VI (ENDF-VI). Work will include format modifications that will permit the inclusion of double differential cross-section data required for fusion reactor blanket and shielding design calculations and the reevaluation of nuclear data files for which new measurements have provided data of significantly improved quality. ENDF-VI will make use of new analysis methods that have been developed for the treatment of correlations among measured values of nuclear parameters. The second major data base activity is the continuous updating of the Evaluated Nuclear Structure and Decay File (ENSDF), from which the widely used Nuclear Data Sheets are produced. This effort includes significant contributions from international collaborators; the NNDC is responsible for overall coordination and review of ENSDF activities. The FY 1987 request budgets $2,375,000 in operating expenses and $75,000 in capital equipment for Brookhaven National Laboratory for support of NNDC activities.

The largest effort within the Nuclear Data activity is assigned to the performance of precision nuclear measurements vital to the improvement of the data base. The major United States facilities for carrying out nuclear data measurements are the Oak Ridge Electron Linear Accelerator (ORELA), the Argonne Fast Neutron Generator (FNG), and accelerators at the National Bureau of Standards. A major improvement in the short-pulse capability of ORELA, which established this machine as the premier facility for measuring neutron cross-sections by the powerful time-of-flight method, has recently been achieved. This increased capability will help greatly a new program to improve knowledge of experimental energy resolution functions to better characterize cross-sections in the region of resonance reactions. To make possible accurate measurement of neutron capture cross sections of the fissile and fertile isotopes, a large angle photon-multiplicity detector will be constructed at ORELA in FY 1986 and in FY 1987, when initial experiments are planned. With this detector, scientists will be able to distinguish with relatively high certainty between neutron capture and neutron-induced fission events. Total cost for this detector project is estimated at $480,000 in capital equipment funds--$270,000 in FY 1986 and $210,000 in FY 1987. The FY 1987 request includes $3,425,000 in operating expenses and $445,000 in capital equipment for ORELA's research and operations, including completion of the photon-multiplicity detector and participation in Cross Section Evaluation Working Group activities.

At the Argonne FNG, emphasis will be placed on cross-section measurements at higher neutron energies, up to 20 MeV, for materials of importance to the fusion energy program, including measurements of activation reactions that have been identified as high priority needs. Capital equipment funds will be provided in FY 1987 to ensure that state-of-the-art measurements can continue to be made at the FNG. The FY 1987 request includes $890,000 in operating expenses and $100,000 in capital equipment for FNG's research and operation, including participation in Cross Section Evaluation Working Group activities.

At the National Bureau of Standards, a continued effort will be applied to the measurement of neutron standard cross-sections including the fission cross-sections for U-235. In this precision effort, the development of new detectors has also been found necessary. In FY 1987, $645,000 in operating expenses is planned for work at the National Bureau of Standards. Other work planned for FY 1987 includes nuclear data measurement, compilation, and evaluation efforts at Los Alamos National Laboratory, Idaho National Engineering Laboratory, Lawrence Livermore National Laboratory, Lawrence Berkeley Laboratory, and eleven universities.

Stanford Synchrotron Radiation Laboratory

SSRL is one of the major synchrotron radiation facilities in the U.S. The BES and High Energy Physics (HEP) programs share use of the Stanford Positron-Electron Asymmetric Ring (SPEAR); SSRL, which is funded by the BES program, reimburses the Stanford Linear Accelerator Center (SLAC), which is funded by the HEP program, for SPEAR operating costs for those periods when SPEAR is operated in a mode optimized for synchrotron radiation research, approximately five months a year. Operating costs of SSRL are provided by the Nuclear Sciences subprogram, while the scientists who use SSRL's capabilities receive their research support from other sources, including the NSF. Qualified users from university, industry and government laboratories compete via proposal review for time on SSRL and the best are chosen for assignment of time without cost.

The active areas of research conducted at this facility are many, including materials, biology, physics, medicine and chemistry. Structures, surfaces, very thin layers, and interfaces between metals and semiconductors are among the materials thrusts. Microscopic structures of delicate proteins and living cells are among the innovative biological areas. The span of other areas is typified by: fragmentation of molecules by high energy photons, microminiaturization of integrated circuits and noninvasive angiography. The noninvasive angiography is especially interesting in that it should reduce the number of lives currently lost in the course of invasive angiography manipulations.

The request for operating expenses of SSRL is $8,068,000, an increase of $1,005,000 above FY 1986. There are three needs which will be only partially met by this request: (1) Charges by SLAC for operation of SPEAR were sharply increased in FY 1985, which has caused severe curtailments in SSRL's operation. Indications are that the SPEAR charges will be further increased. (2) Costs of electric power to SSRL will go up further due to a rate increase and the need for extra power from a higher priced supplier when the Stanford Linear Collider begins operation. (3) Costs are increasing for assistance to users, administrative costs, and undulators, multiundulator, wigglers and added experimental stations.

The request for capital equipment is $725,000. These funds are required for the many kinds of optical, electronic, vacuum, magnetic, computer and temperature control equipment used to maintain and improve capabilities at SSRL's nearly two dozen beam lines and experimental stations. Much of the existing equipment has become outdated and some of the beam line mirrors and other optical components have experienced measurable deterioration after 5 to 10 years of use.

Construction funds of $150,000 for general plant projects are requested for the electrical system. The electrical cabling of SSRL has become seriously overloaded with the many added beam lines and experimental stations of the past decade.

Heavy Ion Fusion Accelerator Research (HIFAR)

Heavy ion fusion, using intense beams of heavy ions from high energy accelerators, refers to one of the three major methods of inertial fusion, the others being laser fusion and light ion fusion, which use different technologies. From 1976 to 1983 a low-level program, including four national workshops, was conducted and the concept of heavy ion fusion was endorsed by several major reviews. A multi-year, two-phase program was formulated in 1983 and begun in FY 1984 to develop and evaluate the required heavy ion technology for future decision making. Phase I emphasizes construction of a multiple-beam experiment (MBE) at the Lawrence Berkeley Laboratory (LBL) to demonstrate the induction accelerator method. Accelerator innovations include beam current amplification and operation at the space charge limits in addition to the use of multiple beams. To be completed early in FY 1987, the MBE-4 is a 4-beam experimental test designed as a scaled-down model of the accelerator portion of a larger 16-beam accelerator called the High Temperature Experiment (HTE). Construction and operation of the HTE will constitute Phase II of the program and allow experimental evaluation of heavy ion drivers for inertial fusion.

The request for FY 1987 is for $5,905,000, including $5,260,000 operating expenses and $645,000 capital equipment. These funds support operation of MBE-4 at LBL, development of a 16-beam injector at the Los Alamos National Laboratory, and research on certain critical components for the 16-beam HTE. However, funds are not included for development of 16-beam prototype accelerator modules.

Recent accomplishments in the HIFAR program include: development of preliminary conceptual designs for the HTE based on the use of medium-mass ions such as sodium; confirmation of the feasibility of much higher beam currents than previously thought possible; completion of the MBE-4 engineering design; and successful operation of the MBE-4 cesium ion source.

	FY 1985	FY 1986	FY 1987 Request
Applied Mathematical Sciences			
Operating Expenses......................	$ 34,467	$ 37,925	$ 32,785
Capital Equipment.......................	1,500	1,030	1,100
Construction............................	0	4,811	0
Total Applied Mathematical Sciences...	$ 35,967	$ 43,766	$ 33,885

The Applied Mathematical Sciences subprogram will meet the immediate needs for scientific supercomputing in the research programs supported by the Department's Office of Energy Research and the long range needs of the Department in computational research. The program consists of two parts: Energy Science Advanced Computation and Applied Mathematical Sciences Supercomputing Research. The Energy Sciences Advanced Computation subprogram provides network access to supercomputers for Office of Energy Research contractors and grantees in universities, industry, and DOE national laboratories. The Supercomputing Research subprogram supports research in mathematical and computer science that is vital to understanding the newly emerging parallel processor supercomputer systems and the long range development of future supercomputer systems.

In recent years, the modern supercomputer has changed the nature of scientific research and technology development. The advancement of science used to depend upon experiments for data and theory for understanding. Today there is a third equally important ingredient to scientific research: computational science. Computational science serves a role that is a hybrid between theory and experiment. In some cases, computations provide insights into experimental data, and in others, computations are used to simulate the ideal experiment to test an analytical model. The emergence of computational science as an important element in scientific research and technology development is the result of the development of our ability to do computational modeling of complex physical problems and the enormous power of the modern supercomputer. This combination allows scientists and engineers to model complex problems in a much more realistic way and to obtain much more accurate answers than was possible just 5 years ago.

Scientific supercomputing now makes substantial contributions to many fields of research such as fluid dynamics, plasma dynamics, astrophysics, materials science, chemistry, atomic physics, etc. Similarly, large scale calculations are making significant contributions to product development in areas such as nuclear weapons, electronics, automobiles, aircraft, and chemicals. In product development, computer modeling is used to reduce the number of design/test iterations that are so time consuming and expensive.

The Department of Energy (DOE) has made a significant commitment to scientific supercomputing in several of its research and development programs. As an agency, DOE is the largest user of supercomputers in the world. In 1986 DOE laboratories will house 26 supercomputers. DOE's commitment to scientific computing is not new. Historically, the Department and its predecessor agencies (the Atomic Energy Commission and the Energy Research and Development Administration) caused many supercomputers to be developed through its nuclear weapons design work at the Lawrence Livermore National Laboratory and the Los Alamos National Laboratory.

The supercomputers that were developed in response to DOE needs were delivered to the DOE laboratories nearly devoid of software, requiring our laboratories to develop the necessary software for a complete supercomputer system. Through the software development efforts and the continual interaction between DOE laboratories and the supercomputer vendors, DOE has made significant contributions to supercomputer technologies.

Although DOE's defense efforts still represent the largest use of supercomputers, other DOE programs have become significant users and are also contributing to the further development of the technology. The Magnetic Fusion and Naval Reactors programs have been using supercomputers for many years. Other DOE programs such as Uranium Enrichment, High Energy and Nuclear Physics, Basic Energy Sciences, and Biological and Environmental Research have just begun to make significant use of supercomputers.

Great progress has been made in our ability to do computer modeling of complex scientific problems; however, there is still a long way to go. Many of the Department's research and development programs have large, complex research and engineering problems to solve that can be only crudely approximated with today's supercomputers and mathematical techniques. There is a need to include more physics in the models, to use finer zoning for more accurate answers and to attempt to model in three dimensions. In order to solve these complex problems to the accuracy desired in the future, computers with substantially increased computing power over those currently available will be required. Several DOE programs have estimated that they will require computers 200 times as powerful as a Cray XMP or a Cyber 205 by the end of the decade. In fact, some of the DOE programs could use that kind of computing power today, if it were available.

Applied Mathematical Sciences Supercomputing Research

The primary objective of the research activity is to advance the understanding of the fundamental concepts of mathematics, statistics, and computer science underlying the complex mathematical models of the key physical processes encountered in the Department's research and development programs. In addition, this activity supports investigations of new computer architectures that may lead to new approaches to supercomputers. The research activity provides the primary source of funding for applied mathematics and computer science research to meet the DOE needs in this area.

The DOE scientific research community comprises a large fraction of this country's expertise in large scale computational modeling, with applications in fusion energy, weapons design, and fundamental physical scientific research. Much of the scientific research and development effort throughout DOE programs is focused directly on analytical and numerical modeling of physical processes. An understanding of the fundamental principles upon which these models are based is important for developing energy production and distribution systems for the future. Thus, research in mathematical analysis, algorithms, and computational techniques is crucial in conducting most scientific investigations. DOE's lead role in the development and application of supercomputing techniques is based on this fundamental research.

One goal of the research activity is to develop our ability to use parallel processor computer systems to model complex physics phenomena. The parallel processor direction for supercomputers is dictated by the fact that only very limited gains can be made from increased component speeds and levels of integration in the future. This has caused computer architects to look to using more than a single processor working on a problem. In the near term, the supercomputer vendors are producing systems with 2-16 processors. In the longer term, systems with 100's to 1000's of processors are expected. The change from von Neumann (sequential) to parallel processor machines represents an enormous change in scientific computing, greater than the challenge faced by the introduction of vector processors. The challenge with parallel processors is to have a large number of processors efficiently working simultaneously on the same problem. New software, languages, algorithms, and entirely new mathematical approaches to solving scientific problems will be required.

This subprogram supports basic research at many of the DOE national laboratories, universities, and private research institutions in three major activities: Analytical and Numerical Methods, Information Analysis Techniques, and Advanced Computing Concepts. Analytical and Numerical Methods includes analytic and numerical techniques for solving systems of partial differential equations; Information Analysis Techniques includes data management and statistics; Advanced Computing Concepts includes software methodology and research on high performance systems. Regular meetings with program managers in other Federal agencies help coordinate these activities. Two such groups established to coordinate government sponsored research programs are the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET) panel on high performance computing research and the Interagency Committee on Extramural Mathematics Programs (ICEMAP). DOE is one of the ICEMAP sponsors of the new Board for Mathematical Sciences in the National Research Council of the National Academy of Sciences.

Recent accomplishments of this research activity in computational science include the following:

- A fast algorithm, called "successive linkage," well suited for lattice problems involving large summations of potentials with local interactions was discovered. The key step in this algorithm is the identification of frequently appearing terms in the summation together with a method for estimating the frequency with which a given term appears. It has been tested on the exactly solvable two-dimensional Ising model which is used to describe ferromagnetic materials and yields best possible results among all exact summation algorithms for finite square lattices. Extrapolation methods were also developed which enable one to accelerate convergence to thermodynamic limits in infinite lattices.

- A new class of high resolution finite difference methods for modeling compressible fluid flow problems with discontinuities has been developed. These methods incorporate the nonlinear wave propagation properties into the algorithm, leading to methods that are stable and robust in the neighborhood of shock waves and slip surfaces and are still highly accurate in regions of smooth flow. These methods have resolution capabilities that are close to the theoretical maximum attainable and represent a major advance in the state of the art that is unlikely to be surpassed in the near future. These methods are being incorporated into large application programs used in the weapons design and laser fusion projects.

- The University of Illinois established the new Center for Supercomputing Research and Development whose goal is to demonstrate the effectiveness of their "CEDAR" design strategy for parallel architectures and associated algorithms and software. Major support for the Center is being provided by DOE; the State of Illinois is providing faculty positions and building space. Center faculty and staff consists of interdisciplinary teams with expertise in problem decomposition, parallel algorithms, architectures, and networking, including close collaboration with the Mathematics and Computer Science Division at the Argonne National Laboratory. Leaders from the supercomputer industry have applauded the formation of the Illinois Center and state that such centers are the appropriate places to carry out the research required for new generations of supercomputers.

In FY 1985, an enhancement in the research effort in large scale scientific computing was started, with emphasis on algorithms for large scale parallel architectures based on several experimental computer systems under study. The emphasis on new parallel processor architectures applies to all three activities of the research subprogram.

The R&D projects envisioned have two important facets requiring substantial cooperation and coordination among traditionally separate groups. One facet is the interdisciplinary teams of computational scientists, computer scientists, and mathematicians working on all aspects of large scale scientific computing problems. The other is the cooperation of industry, government and universities on the design and engineering of examples of several potentially strong candidate architectures; this will be an important proof of concept activity.

University researchers will play the major role in generating ideas and research software and in training graduate students in generating new applications. Government laboratory staff are in the forefront of tackling real world, large scale scientific problems and have unique resources for participating in these research projects. Industry likewise has a unique role in providing state of the art production and testing facilities and would stand to reap great benefits in understanding future architecture and software issues that tend to limit industry use of supercomputers currently. The transfer of technology from the academic and laboratory research environment to industry will be as rapid as possible through these cooperative projects. The DOE program will be coordinated with the other agencies to share common facilities where possible, such as very large scale integration (VLSI) design facilities and component fabrication.

This subprogram supports interdisciplinary teams including analysts, applied mathematicians, computational scientists, postdoctoral fellowships and graduate students collaborating in universities and national laboratories to research parallel algorithms for mathematical software tools used in implementing these models. As documented in the David Committee's report, "Renewing U. S. Mathematics: Critical Resource for the Future," published by the National Research Council of the National Academy of Sciences, DOE's research program in applied mathematical sciences plays a lead role in support of basic research at the interface between mathematical and computational sciences. The shortage of graduate students and post doctoral support in this crucial area is becoming severe and the current demand for trained computational scientists by industry is rapidly draining the academic pool and the pool of talent available to the National Laboratories. The intent is to strengthen the ties between universities and the Laboratories and to provide salary support and computational resources in the disciplines associated with computational science. The DOE program, with its unique history of basic research in these areas, is positioned to provide strong leadership in filling the "pipeline" from graduate studies to post-graduate studies to research positions in academia and the Laboratories.

Several projects were begun in FY 1985 at the level of between $1,000,000 and $2,000,000 per year to provide for fabrication and software development of parallel architecture research machines. Each project represents a collaboration among universities, national laboratories, and private industry. Funding to support the completion and operation of these research machines is required in order to make these facilities available to researchers at other universities and laboratories via a national network.

The most advanced of these is the Cal Tech Cosmic Cube project initiated by DOE in 1983. In 1984 a 64 processor version of the Cosmic Cube (6-cube) was running a variety of scientific problems, including lattice gauge calculations of the heavy quark potential, problems in astrophysics, seismic exploration, chemical dynamics, and the traveling salesman (simulated annealing) algorithm. The research team supported by DOE includes faculty and graduate students from physics, applied mathematics, computer science, chemistry, geophysics, and engineering. In addition, visitors from DOE laboratories and other universities are participating in this project under separate support. Intel and DEC donated a large amount of equipment to this project. Intel recently announced the commercial version of the 5, 6, and 7-cube based on the new Intel 80286/80287 processor set. Problem decomposition techniques and multiprocessor software is available from the Cal Tech group. Interest in acquiring the Intel cubes has been expressed by at least three DOE laboratories and several universities. In FY 1985, a 128 processor version of the Cosmic Cube (7-cube) was brought up and continues to run reliably.

Research completed to date has demonstrated the viability of this approach for the homogeneous system design. The scalability of this architecture to very large scale parallelism in a variety of problems needs to be verified experimentally. This requires continuation of the current plans to an experimental machine capable of handling problems of realistic complexity. In FY 1986, the project plans to continue the relationship with the Jet Propulsion Laboratory's engineering and fabrication resources to build a much more general purpose version of the Cube, using a modern microprocessor with vector floating point capabilities (a shortcoming of the 16-bit Intel chip in the first Cube). This experimental machine will offer modern operating system utilities that will provide a much more general environment for scientific problem solving.

These projects represent several investment strategies. The first is a collaboration with a large industrial partner providing engineering design and implementation, with a well known DOE Laboratory/university partner providing the mathematical and computer science expertise for scientific applications. The second represents a large DOE supported university group providing again the mathematical and computational science expertise and a government sponsored laboratory providing the engineering design and implementation. The third represents a large, experienced university and laboratory group using mostly "off the shelf" components and far advanced in the development of software for scientific applications.

The FY 1987 request is $22,650,000. Plans for additional facilities and capital equipment projected for the large projects will be deferred until later years, when suitable research machines can be made available. The FY 1987 capital equipment budget request is $500,000.

Energy Science Advanced Computation

With the advent of modern supercomputers and the maturing of computational techniques, computational science has joined experiments and analytical theory as an equal and very essential tool in the advancement of science and technology. The Energy Science Advanced Computation program provides computational support for research programs (other than Magnetic Fusion) that are supported by DOE's Office of Energy Research (OER). These OER programs include High Energy and Nuclear Physics, Basic Energy Sciences, and Biological and Environmental Research. The goals of the Energy Science Advanced Computation program are:

- to provide access to modern supercomputer systems for researchers that are funded through the OER programs;
- to build the knowledge base needed to improve computational technologies throughout the OER programs;
- to provide more effective computational tools for supercomputer systems in use by the OER programs; and
- to shorten the lead times required to implement the results of the OER Supercomputer Research program into existing OER applications and supercomputers and systems software.

The OER researchers served by this program are geographically dispersed throughout the United States and have collaborations with research communities overseas in Europe and Japan. During FY 1985, an enhanced Class VI computer system was installed at the National Magnetic Fusion Energy Computer Center (NMFECC) to provide computational support to these OER programs through the nationwide Magnetic Fusion Energy data communications network (MFENET).

This enhanced Class VI computer system has been very instrumental in the progress of the OER research programs, such as designing and modeling of the physics of high power klystrons, determining the electron energy band structures of new classes of materials, e.g., heavy fermion materials, and ecological modeling the theory for "faunal buildup of competition communities." This enhanced Class VI computer system has been operating at over 90% utilization level (24 hour/day, 7 days/week) since its second month of installation.

Recent accomplishments in the Energy Sciences Advanced Computation activity include the establishment, during FY 1985, of a Supercomputer Computations Research

Institute (SCRI) at the Florida State University, the expansion of the MFENET to include over twenty (20) new geographical sites, the addition of over 1200 supercomputer users actively engaged in OER research projects at the NMFECC, and the development of the first timesharing operating system for operation on a multiprocessor supercomputer configuration. This operating system is targeted for use at two of the new NSF supercomputer centers during FY 1986 and will be supported by the NMFECC. The SCRI was established via a cooperative agreement to conduct research in computational science related to the OER mission, to develop effective computational tools and systems software for use on supercomputer systems, and to operate a supercomputer facility. The SCRI installed a CDC Cyber 205 computer system, of which approximately 65 percent of the system capacity was used for OER related work and over 80% of this capacity had been allocated to university researchers. This operation was also incorporated as a major node on the MFENET for nationwide access.

For FY 1987, a total of $10,135,000 in operating funds is requested. Based on the need to balance the budget, funding for the Florida State Computer Center has been eliminated. These funds will be used to provide additional network capabilities for this supercomputer access program including remote user processor upgrades, replacements and installations, to provide a replacement file management/mass storage system for the obsolete CDC 7600 and 38500 cartridge devices, and to allow for increases at the NMFECC for supplies, utilities, salaries, communications lines, and hardware maintenance. The distribution of costs is: $1,600,000 for network access facilities and equipment; $500,000 for lease-to-ownership of a file management systems and mass storage; and $8,635,000 for lease and operation of the enhanced Class VI computer system. However, due to the magnitude of the increases for software, support costs and communication bandwidth upgrades, the current lease of the enhanced Class VI computer system will be converted to a lease-to-ownership arrangement.

Also, it should be noted that separately identified under this activity is a Major Item of Equipment, a Class V computer system which was initially procured in FY 1986, at the Argonne National Laboratory (ANL). This system while only partially funded in this program is essential to replace an existing outdated system at the ANL.

For FY 1987 capital equipment funds in the amount of $600,000 are requested to provide replacement parts and low cost mass storage peripherals at the NMFECC.

	FY 1985	FY 1986	FY 1987 Request
Engineering and Geosciences			
Operating Expenses....................	$ 26,085	$ 25,571	$ 29,412
Capital Equipment.....................	1,500	1,443	1,750
Construction..........................	0	7,698	0
Subtotal........................	$ 27,585	$ 34,712	$ 31,162

This subprogram provides for the principal research efforts of the Department of Energy in the various areas of engineering and the geosciences, particularly in the disciplines of mechanical engineering, electrical engineering and engineering physics, geology, geophysics and geochemistry. Research projects are selected for scientific excellence and their expected long-term impact on solutions to the Nation's energy-related problems, ultimately to meet the Nation's need for adequate energy supplies at reasonable costs.

The FY 1987 request, $29,412,000 for operating expenses and $1,750,000 for capital equipment, provides for maintaining a sound balance of activity in each of the established areas of program focus, with about the same number of engineers and geoscientists participating in these important aspects of energy research as were involved in FY 1985.

The research to be supported with the requested operating funds is discussed in some detail below. The capital equipment funds requested will be for equipment urgently needed at the national laboratories such as testing and measuring equipment needed for plasma processing research at the Idaho National Engineering Laboratory (INEL), various devices and accessories needed for research at Oak Ridge National Laboratory on intelligent machines for repair and other operations in hostile, changing environments, and for detectors and signal processing equipment needed for research on advanced seismic and electromagnetic methods in geophysics at the Lawrence Berkeley and Livermore National Laboratories.

Engineering Research

Engineering Research in this subprogram pursues two main objectives to meet the long-term basic research needs of both current and future energy technologies: (1) to improve and advance our knowledge of processes underlying current engineering practice for the purpose of enhancing energy production and savings, prolonging useful equipment life, increasing the efficiency of energy systems and reducing costs of operation while maintaining output and performance quality, and (2) to expand the technical data base and knowledge of fundamental concepts for solving anticipated and unforeseen engineering problems in energy technologies. Fundamental research is supported in both traditional engineering disciplines and interdisciplinary areas, addressing problems related to energy production, distribution, and utilization.

The breadth of application and the character of the research projects supported in Engineering Research are shown by the impact of the results on various energy technologies. For instance, the principles underlying the flow of multiphase fluids (i.e., mixtures of gas and liquids) must be well understood to solve many problems in the petroleum and chemical industries as well as in specific energy supply systems; for example, geothermal, nuclear and solar. Research on generic topics such as these is essential to ensure preparedness and flexibility in addressing the Nation's future energy needs, as well as competitiveness in world markets.

To optimize its impact and use of funds, Engineering Research focuses its research activities on three main categories: (1) Mechanical Sciences, (2) System Sciences and (3) Engineering Data and Analysis. Research supported under the Mechanical Sciences focus includes: fluid mechanics, heat transfer, combustion, solid mechanics and structures, damage and fracture mechanics, and tribology. Systems Sciences includes: systems analysis, synthesis and control, large scale systems, intelligent machines in changing environments, and instrumentation research. Research under the third focus, Engineering Data and

Analysis, includes: the development of important critically evaluated data for energy engineering, mathematical modeling of systems far from equilibrium, and modern engineering analysis, such as analysis needed for understanding the dynamics of nonlinear systems.

Significant accomplishments in Engineering Research have been numerous. A sampling of some of the more recent accomplishments are given below:

- Research on the non-linear interactions between chemical reactions and transport phenomena aimed at understanding aspects of geo-engineering important for uranium mining has unexpectedly yielded new strategies for petroleum exploration. Two major oil companies (Texaco and Exxon) now fund extension and testing of the new techniques.
- Research on the interaction between fluid flow and tube bundles in heat exchangers has led to the discovery of a key source of undesirable noise generation in these essential energy system components. This knowledge will aid the design of efficient, environmentally acceptable (low noise pollution) heat exchangers.
- Critical laboratory experiments have revealed severe limitations on commonly used computer simulation of flow phenomena in enclosures. The results of this research are now used to improve calculation methods for complex heat transfer problems.

The FY 1987 request for this subprogram will provide $14,062,000 for Engineering Research operating expenses. The overall level of effort for Engineering Research will thus be brought back to that of FY 1985. This will provide for strengthened implementation of several efforts for which the first substantial funding was in FY 1985, including both integrated, multidisciplinary efforts (at ORNL, INEL and MIT) and complementary, single investigator-initiated research in small businesses and at universities.

Geosciences

The objective of the Geosciences research is to develop, in areas pertinent to the nation's energy needs, a quantitative and predictive understanding of crustal structure, earth processes and the solar terrestrial interface along with associated advanced techniques and instrumentation.

The earth and the sun are the sources of the world's energy supply. The earth and its atmosphere are the sinks for the wastes generated by energy-producing processes. Thus, increased knowledge in the geosciences is highly important to meeting the Nation's future energy needs. There is need for the development of more advanced methods of energy resource recognition, evaluation and utilization. There is need for an enhanced fundamental understanding of the composition, structure, dynamics and evolution of the earth's crust and how such processes affect natural phenomena such as the distribution of energy and mineral resources, earthquakes, volcanic eruptions, storage and transfer of geothermal energy, the occurrence of fossil fuels and the nature and extent of aquifers.

Geosciences research is carried out principally at the DOE National Laboratories and at universities. The program supports long range research chosen for its scientific merit as well as its special long-term relevance to energy technologies. For example, coordinated projects in geochemical migration and continental scientific drilling address directly and indirectly important long range national energy concerns. Seismic activity, tectonic uplift and increased fumarolic activity at Long Valley-Mono Craters in California have stimulated detailed studies of this area under the DOE Continental Scientific Drilling effort. These studies are part of the joint DOE-NSF-USGS program endorsed last year in a special statutory provision (P.L. 98-473, Section 323).

Geochemical studies of element migration and energy and mass transfer are providing the knowledge base needed to understand the mechanisms of energy and mass transfer in hydrothermal systems, the movement of wastes from geologic repositories, and the concentration and location of energy resources. Research in organic geochemistry is yielding an improved understanding of the origin, development and emplacement of gas, oil and coal deposits and is helping develop a cadre of organic geochemists in U.S. universities where a shortage has existed for many years. Studies of the temperature gradients and tectonic history of subsiding basins lead to a better understanding of the development of energy resources in nature and thus to their more effective exploitation. Development of new geophysical systems and their use in resource exploration are leading to improved methods of locating and defining energy resources and for modeling crustal systems. Recent Geosciences accomplishments include the following:

- Cooperative Seismic Studies at Long Valley, CA. The interagency, cooperative nature of the geophysical studies relating to DOE scientific drilling activities in the vicinity of the Long Valley Caldera is illustrated by the fact that four Federal agencies are involved, one state agency, seven universities and one industry in an effort totaling about $2.8 million with DOE providing about 20 percent of the total costs. This concerted effort is attempting to pin down the three-dimensional configuration of the Long Valley/Mono Craters area and determine the locations of magma bodies. The overall effort was initiated as a direct result of the careful, nationwide search under the auspices of the BES Geosciences activity for sites most likely to fulfill the scientific objectives for continental scientific drilling in regions of high heat flow (i.e., in thermal regimes).

- Field Tests Carried Out of Alterant Geotomography. Tomography has become familiar in medical applications, but suitable data are rarely available for imaging sections of the earth below the surface. A new technique for this purpose features use of electromagnetic waves and injection of conductive (or insulating) fluids through bore holes to alter the conductivity. The first field test was just completed. The "before," "after" and "difference" images clearly show permeable pathways through which the injected fluid moved.

The request for FY 1987 operating expenses for Geosciences is $15,350,000. The request will enable program support at about the FY 1985 level of effort and permit the strengthening of the small but profoundly influential project on worldwide effects of past asteroid impacts. To the extent possible within this framework, the Department's thermal regimes drilling activities will be maintained as a key part of the interagency Continental Scientific Drilling Program.

	FY 1985	FY 1986	FY 1987 Request
Advanced Energy Projects			
Operating Expenses......................	$ 10,048	$ 7,286	$ 8,932
Capital Equipment......................	320	308	330
Total Advanced Energy Projects.......	$ 10,368	$ 7,594	$ 9,262

The objective of the Advanced Energy Projects subprogram is to explore the feasibility of novel, energy-related concepts, as they evolve from basic research. Such concepts are at an early stage of scientific definition and, therefore, would not qualify for support by technology programs. Because they are new and untried, those concepts invariably represent a high risk; to qualify for support they must also have the potential for an eventual high pay-off. Also supported is exploratory research on concepts that do not fit easily into the existing Department of Energy program structure. An area of major programmatic attention is the transfer of successful projects to proper technology programs; such transfers are effected every year.

Exploratory research on novel concepts is needed to provide the seed for technical innovation. However, such research does not generally qualify as basic research, where the objective is to gain knowledge and understanding of processes and phenomena in nature. Neither does it qualify as technology-related: the link with any specific technology needs yet to be established. Hence, the Advanced Energy Projects subprogram fills a very real void between basic and technology-related research.

Thus, for example, several novel approaches to controlled fusion--very different from those currently pursued--have been proposed as a result of basic research. One such approach, known as "muon-catalyzed fusion," evoked considerable interest and produced unexpectedly promising results; however, this research is still at too early a stage to determine if muon-catalyzed fusion can be considered a viable process for energy generation. The concept is actively being explored under Advanced Energy Projects sponsorship.

The mode of operation for this interdisciplinary subprogram is to support individual projects for a limited time only; it differs from other subprograms in that it does not fund ongoing evolutionary research. The spectrum of projects supported is very broad, encompassing, for example, the development of new sources of electromagnetic radiation, new methods of better fossil fuels utilization, totally new approaches to controlled fusion and new approaches to solar energy collection and utilization. Close contact is maintained with DOE technology programs to ensure proper coordination. Projects are selected on the basis of unsolicited proposals received from researchers at universities, industrial laboratories (especially small R&D companies) and national laboratories.

In FY 1985, about 40 projects are being supported, which allows a turnover rate of about 14 projects a year. A recent accomplishment of Advanced Energy Projects is the demonstration, for the first time, of a laboratory-scale x-ray laser; the range of potential applications is very broad and includes medicine, microlithography and materials research--to name a few. Also last year, a free electron laser (FEL) experiment supported by Advanced Energy Projects yielded new results of break-through proportions, making FEL a leading candidate for powering new generations of particle accelerators, as well as for other applications.

The FY 1987 request for the Advanced Energy Projects subprogram is $8,932,000 in operating expenses and $330,000 in capital equipment funds. This will maintain the total number of projects supported at about 40 and will allow continuation of the initiative in exploring new sources of electromagnetic radiation such as laboratory scale x-ray lasers. Support for the muon-catalyzed fusion effort will continue at slightly enhanced funding levels.

	FY 1985	FY 1986	FY 1987 Request
Biological Energy Research			
Operating Expenses....................	$ 12,360	$ 11,960	$ 14,538
Capital Equipment.....................	560	515	610
Construction..........................	0	5,773	0
Total Biological Energy Research....	$ 12,920	$ 18,248	$ 15,148

The Biological Energy Research (BER) subprogram supports research activities in both the plant and microbial sciences. The objective of this subprogram is to obtain the fundamental knowledge required for the future development of biological systems that produce or conserve energy resources. The research emphasis is directed towards understanding biological mechanisms. The program areas in the botanical sciences are directly related to plant productivity, including research on the main energy supply mechanism for living organisms, photosynthesis and the related fields of plant bioenergetics and metabolism. Research on the structure and function of the complex carbohydrates that make up the plant cell wall are of particular interest as these chemicals not only provide structural support for the plant, but also constitute the major renewable energy resource. Recently, the carbohydrate components of the cell wall have been implicated in having significant roles in plant regulatory processes, development and protection against pathogens. Studies are supported on the molecular mechanisms involved in the regulation of plant metabolism and development which are again directly related to plant productivity and energy conversion efficiency. The molecular events involved in the adaptation of plants to environmental stresses, as well as the molecular and cellular interaction of plants and microorganisms, both symbiotic and pathogenic, are likewise areas of interest as these interactions are often the limiting factors in plant growth. Research on the physiological genetics of plants and the associated genetic expression mechanisms can provide the information necessary to develop plant types with superior characteristics for efficient plant resource production.

The microbiological studies supported by the BER program are primarily concentrated in the areas relating to fermentation biology and to the interaction of microbes with plants. The objective of the fermentation research is to understand, at the molecular and cellular level, the microbial conversion of renewable substrates to potential fuels, chemicals or chemical feedstocks. The research emphasis is on the degradation of the major biological polymers, cellulose, hemicellulose and lignin. The degradation of these polymers frequently involves several types of microbes acting in concert. The nature of these interactions and the enzymes that are responsible for the degradation process all are active subjects of research. Methane, a common end product from the natural degradation of polysaccharides, is generated by certain anaerobic bacteria. The process of methanogenesis and the study of the organisms responsible along with the study of other neglected microorganisms with the potential for novel and valuable fermentations, have been areas of special effort by the BER subprogram. Examples of the category of plant microbial interactions include studies on symbiotic nitrogen fixing bacteria and the microbial processes that alter the properties of soils such as the bacterial process of denitrification of soils.

In certain areas of biotechnology at least, it is becoming more apparent that the most serious limitation to achieving new genetically tailored products (particularly plants and certain microorganisms) is the lack of understanding of the traits to be altered ("targets"). Thus more attention is needed in understanding the fundamental genetics, physiology and biochemistry of organisms. Such studies must become more prominent to balance the very rapid progress being made in such areas as development and use of new genetic vectors for transmitting DNA, unraveling of questions of how genetic messages are read and expressed and other molecular biological areas. In fact, it might be said that the competitive U.S. position in regard to the application of genetic engineering in biotechnology could be undermined if insufficient attention is given to building the strong biological understanding needed to apply the elegant genetic techniques. Clearly, the U.S. maintains a commanding dominance in respect to the genetic aspects of biotechnology, but with respect to such areas of fermentation technology and natural products chemistry, no such lead exists.

Two representative research advances evolving from the BER program this past year include:

1. The obtaining of evidence from Raman microprobe spectrographic analyses that lignin, the noncarbohydrate portion of plant cell walls, exists in a highly ordered orientation with the aromatic subunits being arranged parallel to the plane of the cell wall. Such information could lead to the development of new strategies for performing chemical and microbial degradations.

2. The pigment, phytochrome, which controls numerous morphological developments in plants, has only recently been shown to exist as two distinct molecules, one as found in dark grown (etiolated) plants, and the other as typically found in light grown green plants. The protein characterization has been performed in association with cloning of the genes for these proteins. Such results could lead to a better understanding of light controlled development in plants and ultimately plant productivity.

The funding requested will permit the continued support of current projects at adequate funding levels, with enhanced support being allocated for several ongoing projects in the area of complex carbohydrates and several neglected areas of plant and microbial research. A recent workshop on future research directions has identified these currently funded areas and several other research opportunities as meriting a high priority for enhanced funding. An effort also will be made to respond to a few of the numerous very high quality research opportunities presently available in these areas.

	FY 1985	FY 1986	FY 1987 Request
Program Direction			
Operating Expenses........................	$ 3,830	$ 3,499	$ 4,125
Total FTE's...............................	63	63	63

The FY 1987 request for Basic Energy Sciences Program Direction is $4,125,000. These funds are required to provide for the personnel and other costs associated with 63 full-time equivalents. The additional funds will provide for within-grade and merit increases, and other increased costs associated with management of this program.

Basic Energy Sciences is a broadly diversified program responsible for mission-oriented research, the chief purpose of which is to provide the fundamental scientific and engineering base on which the Nation's future energy options depend. Its staff must possess expertise covering many subfields in the areas of chemistry, physics, engineering, metallurgy, geosciences, mathematics, and biology, as well as in administration, procurement and financial management. The staff is responsible for development, direction, and management of complex technical programs, each involving one or more of the scientific areas mentioned above. Their activities include assessing scientific needs and priorities of the program, planning to meet those needs, technical review of proposals from laboratories and universities, and monitoring the progress of ongoing university contracts, laboratory programs, and construction projects, as well as responding to the many day-to-day requirements involving budget, procurement and other management activities.

The research effort involved in the Basic Energy Sciences program is extremely diverse. In FY 1986, for example, over 1,200 research projects will be underway either at the Department's laboratories or at more than 150 colleges and universities in 45 states. Evaluation, monitoring and management of this large number of diverse projects are done almost entirely from the Headquarters and require frequent contact with the contractors and laboratory staff, involving numerous workshops, planning meetings, and project and program reviews throughout the year. During recent years the number of research projects at universities, with industry and not-for-profit organizations has increased from 18 to nearly 30 percent of the BES budget, and the BES staff workload per offsite project is significantly greater than that for a laboratory project. This is especially true with regard to evaluation of proposals, of which approximately 10 percent of those reviewed result in new contracts or grants each year. The requested staffing level is required to maintain a strong core program; to evaluate research programs including those in newer emerging priority areas having great potential importance to energy; to oversee management, operation, and ongoing construction of unique research facilities; and to promote early application of the results of this basic research.

In addition to the ongoing basic research program, the Congressionally mandated SBIR program (Public Law 97-219) is managed by this staff. This program has resulted in a heavy workload requiring extensive use of overtime and diversion of other scientific and administrative staff from their regular duties to assist in the SBIR work. FY 1986 is the first year all three phases of the program are in operation at the same time. This results in increases in the numbers of proposals to be processed and evaluated, procurements and projects to be monitored and evaluated, site visits for those projects entering Phase II, and debriefings requested by proposers not receiving awards. This effort will continue during FY 1987.

The BES program also funds the Scientific Computing Staff which was established to manage two important activities related to large-scale scientific computing: (1) the Applied Mathematical Sciences research subprogram, with research projects at ten national laboratories and over 30 universities, and (2) the Magnetic Fusion Energy Computer Network, which supports supercomputers for over 2,000 ER research contractors. Specific workload includes assessing scientific needs and priorities of the program; planning to meet those needs; managing a large number of research projects, including conducting peer reviews and evaluating proposals from laboratories and universities; monitoring the progress of ongoing university contracts and laboratory programs; managing the Magnetic Fusion Energy Computer Network; and providing a single DOE focal point to maintain liaison with other Federal agencies on policy matters concerning basic research and access to supercomputers.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
BASIC ENERGY SCIENCES

(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Beam lines and support area construction
National Synchrotron Light Source (NSLS)
Brookhaven National Laboratory, Upton, NY

2. Project No.: 84-ER-111

3. Date A-E work initiated: 1st Qtr. FY 1984

3a. Date physical construction starts: 2nd Qtr., FY 1984

4. Date construction ends: 4th Qtr., FY 1987

5. Previous cost estimate: $19,428

6. Current cost estimate: $ 19,428
Less FY 1983 PE&D: 0
$ 19,428

Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1984	$ 2,500	$ 2,500	$ 2,500	$ 1,396
1985	7,400	7,400	7,400	3,290
1986	6,928	6,928	6,928	6,528
1987	2,600	2,600	2,600	8,214

8. Brief Physical Description of Project

Current program planning anticipates the need for the insertion devices (wigglers and undulators) and beam lines (front and end beam transport and experimental stations) to the existing VUV and X-ray rings. Design, fabrication and construction of up to three insertion devices and six beam lines is presently anticipated with the final configuration to be dictated by programmatic demands and the state of the art at the time of construction.

The project also provides for design and construction of building space to house technical work areas, laboratories and offices and provide additional experimental staging and support areas.

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1. Title and location of project: Beam lines and support area construction
National Synchrotron Light Source (NSLS)
Brookhaven National Laboratory, Upton, NY

2. Project No.: 84-ER-111

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8. Brief Physical Description of Project (continued)

A. New Experimental Equipment

This project provides for an expansion of experimental capabilities which will be made available to general users from university, industrial, national and government laboratories. The greatest use is anticipated to be by materials scientists, but sizeable participation is expected by chemists, biologists and other disciplines.

The new equipment will consist of a new wiggler device and the upgrading of a second wiggler, two associated beam lines and ancillary equipment; a soft X-ray undulator and associated beam line; and an infrared beam line. The exact design of this equipment will be determined as the project progresses.

B. New Building Addition

The proposed addition to the NSLS building will provide support and staging areas, laboratories, technical work areas and offices to promote more effective utilization of the NSLS facility. The technical staff will move to new work areas, making more space available for the new beam lines. Extending the experimental space adjacent to portions of the VUV and X-ray storage rings will allow a number of long beam lines with new capabilities to be constructed, permit additional branching of existing ports, and give some extremely useful space to users for specialized support equipment.

The expansion will add approximately 56,500 square feet of new space in a two-story addition on the north and east sides of the existing building.

The ground floor includes expanded experimental areas for X-ray and VUV storage rings, an angiography suite, laboratories, offices, technical work areas, a receiving and gas storage area, expanded lobby, mechanical equipment rooms and several public rooms. A tunnel connecting the ground floor to technical work space in an adjacent facility will be provided. First floor gross area is 28,912 square feet.

The second floor includes offices, technical work space, design and conference rooms and a mechanical equipment room. Second floor gross area is 27,569 square feet, larger than the original concept by 4,650 square feet in order to accommodate the increased need.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Beam lines and support area construction
National Synchrotron Light Source (NSLS)
Brookhaven National Laboratory, Upton, NY

2. Project No.: 84-ER-111

8. Brief Physical Description of Project (continued)

The additions will be designed to current DOE energy conservation standards and contain fire protection systems. Access by handicapped persons will be provided.

C. Existing Facility

The NSLS consists of two electron storage rings, an injection system common to both, experimental beam lines, experimental equipment, and office and support area all of which is housed in a 74,000 square foot building.

The 2.5 GeV X-ray storage ring provides for the possibility of 28 primary beam ports, each of which is capable of accommodating several experimental beam lines. The VUV ring provides for 16 beam ports which are also capable of accommodating several experiments each. In sum, more than 90 experiments can be carried out at one time when the facility is fully instrumented. In addition to general users, research groups called Participating Research Teams (PRT's) from universities, industry and national and government laboratories, upon advice by a program committee, and approval by the NSLS Department Chairman provide instruments to carry out research programs at the NSLS facility. Their instruments are made available to general users for 25% of the available time. General users are able to use any of the experimental lines, PRT or community lines, upon approval of their experimental proposal. The NSLS is operated as a user facility. This means that researchers from BNL and other laboratories will be able, after review of a proposal by a committee of distinguished scientists, and acceptance by the NSLS Department Chairman to carry out an experiment using either the UV or X-ray radiation produced by the rings.

9. Purpose, Justification of Need for, and Scope of Project

The response from users, both within BNL and outside, has placed a demand on the NSLS facility far surpassing its present resources. The limited beam lines combined with the limited space available makes expansion of experimental research within the present confines of this facility unpracticable. In order to support further development of this facility it will be necessary to provide additional floor, laboratory, and staging space. An experimenter should have a choice of a wide range of instruments which he can utilize for this research. To provide this choice, two types of instruments are proposed:

1. Title and location of project: Beam lines and support area construction
National Synchrotron Light Source (NSLS)
Brookhaven National Laboratory, Upton, NY

2. Project No.: 84-ER-111

9. Purpose, Justification of Need for, and Scope of Project (continued)

a) The insertion device beam lines and the infrared beam line will provide a range of wavelengths and intensities not presently available at bending magnets. These instruments will be used both by general users and by members of the Insertion Device Teams (IDT's).

b) Instruments for general users that will complement those already provided.

A. New Experimental Equipment

The original development plan provided for a small number of bending magnet beam lines. Further instrumentation, also originating in bending magnets, was to be made available by Participating Research Teams (PRT's), who installed beam lines at the rings at their expense and made 25% of the experimental time on their lines available to general users. The growth in user participation has far exceeded earlier expectations.

Developments in recent years has given a high scientific priority to insertion devices. In order to provide this important new experimental capability at the NSLS, it is proposed to accelerate beam line construction. Following the recommendations of the previously noted study committees, it is essential to provide insertion beam lines at the earliest possible date.

B. New Building

The design for the original NSLS building emphasized long term space requirements for the accelerator/storage rings and the equipment associated with their control and operation. Adequate space for experimental beam lines around the VUV and X-ray storage rings was also provided. Future long beam lines that extended beyond the building walls were regarded as a future option.

The space for the machine and experiments was given highest priority in initial design, while support areas were provided to satisfy requirements for projected use during the initial years of operation. A possible expansion of experimental support areas, work areas, and offices was allowed as a future option. Therefore, only minimal space was given to laboratories, the second floor office-administration area, and other support areas. A portion of the

1. Title and location of project: Beam lines and support area construction
National Synchrotron Light Source (NSLS)
Brookhaven National Laboratory, Upton, NY

2. Project No.: 84-ER-111

9. Purpose, Justification of Need for, and Scope of Project (continued)

X-ray experimental floor was occupied by technicians until such time that a need would arise to instrument Ports X1 through X8.

It was projected that during the early years of operations, up to approximately 50% of the 28 X-ray and 16 UV ports would be utilized. Currently, there are 18 beam lines operating at the X-ray ring, 7 more will be ready for operation this year and an additional 17 are in various stages of planning. In the VUV, there are 13 operating, 11 more that will soon be operating, and 11 in planning. The extremely enthusiastic response of the scientific community now forces us to advance the expected rate of beam line construction and building expansion. This response, coupled with the beam lines to be provided by the project, indicates that the experimental floor will be extremely crowded and additional support space would be essential.

The original design anticipated a possible need for future expansion. The building frame was designed to support a third floor over the office administration wing. Site utility lines were kept at least 30 feet from the building foundation. Adequate space was left between the NSLS buildings and the Safety and Environmental protection building.

In addition to the pressing need to return experimental floor space to its intended use, the expansion will provide adequate office space for the permanent staff and work areas to complement the research and development associated with the anticipated programs. The short connecting tunnel between the NSLS building and the basement of the adjacent Instrumentation building will connect the NSLS staging areas to an area where extensive vacuum, instrument, and other NSLS support activities are located.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Beam lines and support area construction
National Synchrotron Light Source (NSLS)
Brookhaven National Laboratory, Upton, NY

2. Project No.: 84-ER-111

9. Purpose, Justification of Need for, and Scope of Project (continued)

Annual Costs

The estimated incremental operating costs of the proposed NSLS beam lines and support area construction are listed below. Costs are in FY 1986 dollars.

	(Dollars in Thousands)
Materials, Supplies, Support Services	$108
Electric Power	278
General and Administrative	46
Total	$432

10. Detail of Cost Estimate a/b/

	Item Cost	Total Cost
a. Engineering, design and inspection, including A-E fee	$	$ 4,080
b. Land and land rights		0
c. Construction costs		12,998
(1) Beam line construction	5,763	
(2) Sitework	105	
(3) Structures	6,730	
(4) Facility Modification	400	
d. Standard equipment		640
Subtotal		17,718
e. Contingency		1,710
Total project cost		$ 19,428

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a/ Estimate is based on awarded conventional construction contract.

b/ Escalation rates conform to the guidelines prescribed in the Department of Energy Field Budget Process Chapter, August 1984, which are based on the materials and labor data contained in the Energy Supply Planning Model and escalation rates forecasted by Data Resources, Incorporated (DRI). Current costs have been escalated by 5.6%, 4.9%, 6.4% and 6.7% per year on beam line construction for FY 1984 through FY 1987, and 6.4%, 5.4% and 4.6% on conventional construction for FY 1983 through FY 1985.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Beam lines and support area construction
National Synchrotron Light Source (NSLS)
Brookhaven National Laboratory, Upton, NY

2. Project No.: 84-ER-111

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11. Method of Performance

Insertion device and beam line construction is unique and therefore the conceptual design, final design, assembly and testing will be done by the staff of the National Synchrotron Light Source of the Brookhaven National Laboratory. Component parts wherever possible will be fabricated by industry under fixed priced competitively obtained procurement actions. Some components may be fabricated in the existing shops at BNL. It is also anticipated that other laboratories, private consultants, and industrial firms will be used for advice on specific problems. Building design will be on the basis of a negotiated architect-engineer contract and its construction will be by a competitively obtained lump sum contract which may be phased.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1984	FY 1985	FY 1986	FY 1987	Total
a. Total project costs						
1. Total facility costs						
(a) Construction line item.........	$ 0	$ 1,396	$ 3,290	$ 6,528	$ 8,214	$ 19,428
(b) CP&D..........................	0	0	0	0	0	0
(c) Expense Funded Equipment.......	0	0	0	0	0	0
(d) Inventories....................	0	0	100	100	0	200
Total facility costs...........	0	1,396	3,390	6,628	8,214	19,628
2. Other project costs						
(a) R&D necessary to complete construction of beam lines....	900	500	500	0	0	1,900
(b) Other..........................	0	0	0	0	0	0
Total other project funding....	900	500	500	0	0	1,900
Total project funding..........	$ 900	$ 1,896	$ 3,890	$ 6,628	$ 8,214	$ 21,528

1. Title and location of project: Beam lines and support area construction
National Synchrotron Light Source (NSLS)
Brookhaven National Laboratory, Upton, NY

2. Project No.: 84-ER-111

12. Funding Schedule of Project Funding and Other Related Funding Requirements (continued)

b. Total related funding requirement (estimated life of project: 17 years)

1.	Operating costs	$ 432
2.	Programmatic operating expenses directly related to the facility	0
3.	Capital equipment not related to construction but related to the programmatic effort	0
4.	GPP or other construction related to the programmatic effort	0
5.	Other costs	0
	Total other related annual funding requirements	$ 432

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding
  1. Total Facility
    (a) Construction line item - no narrative required.
    (b) CP&D - no narrative required.
    (c) Expense funded equipment - no narrative required.
    (d) Inventories - it is anticipated that funds will be required for the procurement of special process spares.
  2. Other project funding
    (a) R&D necessary to complete construction - funds provided in the NSLS R&D budget. This item gives estimates of the R&D necessary to develop the monochromators, mirror systems, target chambers, detectors and superconducting structures for high field wigglers and undulators.
    (b) Other - no narrative required.

b. Total related funding requirements
  1. Operating Costs - There will be an annual requirement of additional materials, supplies, and support services associated with the new beam lines. Also, there will be a requirement for increased facility electrical power.

1. Title and location of project: Beam lines and support area construction
National Synchrotron Light Source (NSLS)
Brookhaven National Laboratory, Upton, NY

2. Project No.: 84-ER-111

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements (continued)

2. Programmatic operating expenses directly related to the facility - no narrative required.
3. Capital equipment not related to construction but related to the programmatic effort - no narrative required.
4. GPP or other construction related to the programmatic effort - no narrative required.
5. Other costs - no narrative required.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
BASIC ENERGY SCIENCES
(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project: Center for Advanced Materials, Lawrence Berkeley Laboratory, Berkeley, California

2. Project No.: 84-ER-112

3. Date A-E work initiated: 3rd Qtr. FY 1984

3a. Date physical construction starts: 4th Qtr. FY 1984

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: $ 40,250

6. Current cost estimate: $ 40,450
Less FY 1984 PE&D: 200
$ 40,250

Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1984	$ 1,760	$ 1,760	$ 1,760	$ 437
1985	9,290	9,290	9,290	1,442
1986	11,008	11,008	11,008	10,174
1987	10,560	10,560	10,560	17,522
1988	7,632	7,632	7,632	10,675

8. Brief Physical Description of Project

The Center for Advanced Materials (CAM) is comprised of two research laboratories. This is a continuation of the FY 1984 request, Center for Advanced Materials (CAM), and which takes into consideration the recommendations of the ad hoc review Panel.

The Research Laboratories will involve two new laboratory complexes at LBL, the Surface Science and Catalysis Laboratory (SSCL) and the Advanced Materials Laboratory (AML).

The CAM facilities at LBL will be located on University of California property adjacent to the Berkeley campus, within the site of the Lawrence Berkeley Laboratory. The project will include the construction of new facilities,

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Center for Advanced Materials
Lawrence Berkeley Laboratory, Berkeley,
California

2. Project No.: 84-ER-112

8. Brief Physical Description of Project (continued)

and the alteration of, and additions to, existing facilities. Plant and site facilities will consist of: a) improvements to land, including grading, drainage, paving, lighting, and walkways; b) a new Surface Science and Catalysis Laboratory (SSCL) building (approximately 47,000 GSF), located near the existing Materials and Molecular Sciences Laboratory (Building 62); c) the new approximately 80,000 GSF building, the Advanced Materials Laboratory (AML); d) the extension of existing utilities, including electrical power, water, sewage, gas, and communications; and e) standard equipment and special facilities including office and laboratory furniture and equipment, fume hoods, ventilation and temperature control equipment, laboratory diagnostics and instrumentation equipment, fire protection equipment and computation equipment.

The Surface Science and Catalysis Laboratory will be located near the existing Materials and Molecular Sciences Laboratory (Building 62). The 3-story building will have a reinforced-concrete frame, shear walls, waffle roof-and-floor structure supported on spread footings. Auditorium and administrative area roofs will utilize metal deck on steel framing. The floor plan is approximately 95 x 150 feet.

The Advanced Materials Laboratory will consist of a single light-laboratory building. The proposed four-story building will occupy a hillside site providing a first floor with a main entrance at the grade level of the base of the hill. The building will consist of two rectangular wings offset in the east and the west directions around a central core with a steel frame structural system. Foundations will consist of poured-in-place reinforced concrete caissons.

Finishes on the new buildings will include: standard built-up roofing over insulation; exterior (non-bearing) walls of prefinished panels on metal studs (insulated cavity); and gypsum board interior wall surfaces throughout. Acoustical ceilings will be needed in certain areas; otherwise ceilings will be painted gypsum board. Laboratory furniture and fume hoods will be commercial products with acid/alkali-resistant tops and construction. Building elevators will be rated for 6000 lb. capacity, suitable for carrying freight and passengers. Heating ventilating and air conditioning (HVAC) needs will be met by central station air-handling units, draw-through cooling coils, return fan units and economizer controls. All supply and return air will be ducted. All buildings will be equipped with automatic fire sprinkler and alarm systems. Utilities will be extended from nearby existing plant services.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Center for Advanced Materials
Lawrence Berkeley Laboratory, Berkeley,
California

2. Project No.: 84-ER-112

9. Purpose, Justification of Need for, and Scope of Project

This research center is being proposed as a major scientific redirection of the Lawrence Berkeley Laboratory to address a vital national need, to accelerate basic research in an area that promises medium-term impact on high-technology industries, and to foster closer ties between national laboratory researchers and their counterparts in industrial and university laboratories. The CAM project will have two major objectives:

- To enhance understanding, through long-range basic research, of the synthesis, characterization, and properties of advanced materials in support of U.S. energy-related and high-technology industry.
- To provide advanced facilities for research training of additional graduate students in physical sciences and engineering fields vital to U.S. high-technology industry.

The CAM project will provide the modern tools and facilities required for making possible major advances in energy-related and high-technology industries by improving the scientific understanding of the underlying chemical and physical phenomena that influence both materials and device behavior.

Two research laboratories form the major components of the CAM:

- The Surface Science and Catalysis Laboratory (SSCL). A laboratory devoted to surface and catalysis studies using state-of-the-art instrumentation techniques.
- The Advanced Materials Laboratory (AML). A laboratory devoted to interdisciplinary study of the synthesis and characterization of energy-related, high-technology, and strategic materials. In addition, there will be research on the design of high-technology devices utilizing new materials and the design of innovative devices for the characterization of materials-property relationships.

Both the SSCL and the AML will be based on strong programs that already exist at LBL. Other elements are completely new, but they too build on experience and personnel already at LBL and at the adjacent University of California Berkeley campus. The first CAM research program associated with the above was initiated in FY 1984.

Because of the pressing need to retain high-technology leadership, the proposed project schedule calls for the start of construction in FY 1984 and the completion of all facilities in FY 1988. Delays would extend the time at which research results can be generated and transferred to U.S. industry. A CAM Advisory Board composed of scientific leaders from industry, universities, and Federal laboratories will advise the LBL director on CAM scientific program

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Center for Advanced Materials
Lawrence Berkeley Laboratory, Berkeley,
California

2. Project No.: 84-ER-112

9. Purpose, Justification of Need for, and Scope of Project (continued)

directions to ensure that CAM basic research addresses America's long-range high-technology needs. The CAM affiliates, consisting of major research teams from industry and universities, will participate in CAM. The following cost estimates and mix among facilities may vary depending upon the research and development progress, but does represent the current plan.

This project will be constructed at the Lawrence Berkeley Laboratory which is non-Government owned property.

10. Details of Cost Estimate

	Item Cost	Total Cost
a. Engineering, design, inspection and administration	4,485	
b. Construction costs	23,864	
c. Standard equipment	6,120	
d. Removals and relocations	600	
e. Contingencies at approximately 15% of above	5,181	
Total estimated cost		$40,250

11. Method of Performance

Conventional facilities engineering design will be performed under a negotiated Architect/Engineer subcontract. Inspection and some engineering will be done by Laboratory personnel. Construction and procurement will be accomplished by fixed-price subcontracts awarded on the basis of competitive bids.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Center for Advanced Materials
Lawrence Berkeley Laboratory, Berkeley,
California

2. Project No.: 84-ER-112

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	Total
a. Total project costs:						
1. Total facility costs [a]						
(a) Construction line item						
SSCL..............................	$ 437	$ 1,022	$ 6,212	$ 4,279	$ 0	$11,950
AML..............................	0	420	3,962	13,243	10,675	28,300
	437	1,442	10,174	17,522	10,675	40,250
(b) PE&D..............................	8	192	0	0	0	200
Total project costs..............................	445	1,634	10,174	17,522	$10,675	$40,450
	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989
b. Other related funding requirements (estimated life of project: 25 years)						
1. Programmatic research..................	2,300	2,800	3,200	6,200	10,500	15,500
2. Capital equipment related to programmatic research..................	1,300	600	460	1,500	2,600	3,900
Total..	$ 3,600	$ 3,400	$ 3,660	$ 7,700	$13,100	$19,400

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[a] Includes escalation to midpoint of construction for all conventional facilities and compounded annually for special facilities; FY 1986 3.8%; FY 1987 $5.0%; FY 1988 5.8%.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Center for Advanced Materials
Lawrence Berkeley Laboratory, Berkeley,
California

2. Project No.: 84-ER-112

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding

(1) The major elements of the CAM facility have been described in Item 8. The funding profiles were determined as follows:

(a) Construction of the Surface Science and Catalysis Laboratory began in April 1985 and will be completed in the second quarter of FY 1987.

(b) The Advanced Materials Laboratory building is scheduled for Title I review in the second quarter of FY 1986. The project will be scheduled to sequence bid packages to minimize disruption to existing programs and construction congestion and to optimize favorable bidding conditions and work leveling. Site bid packages will be let in the third quarter of FY 1986. Building construction will begin in the first quarter of FY 1987 and end in the fourth quarter of FY 1988.

b. Other related funding requirements

The annual costs of the scientific program are increased progressively to build up a high quality research staff for the CAM laboratories. Funding in the early years of the project is mainly to attract superior senior scientists to lead the new scientific programs described in Item 9. These researchers can be housed initially on the University campus and then in the SSCL Building until all conventional facilities are completed. The programs will expand in the latter years of the project to include the full complement of scientists and technicians. The capital equipment needs related to this research staff buildup reflect Laboratory experience that numerous laboratory equipment items will be needed at the level of approximately 20% of the operating program budget. These amounts were augmented in the first two years to take into account startup capital equipment needs.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
BASIC ENERGY SCIENCES

(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project: Stanford Synchrotron Radiation Laboratory Enhancement
Stanford Linear Accelerator Center
Stanford, California

2. Project No.: 84-ER-113

3. Date A-E work initiated: 1st Qtr. FY 1984

3a. Date physical construction starts: 2nd Qtr. FY 1984

4. Date construction ends: 4th Qtr. FY 1987

5. Previous cost estimate: $12,833

6. Current cost estimate: $13,233
Less FY 1983/1984 PE&D: 400
$12,833

Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1984	$ 1,240	$ 1,240	$ 1,240	$ 544
1985	7,413	7,413	7,413	2,661
1986	2,463	2,463	2,463	5,160
1987	1,717	1,717	1,717	4,468

8. Brief Physical Description of Project

The Stanford Synchrotron Radiation Laboratory (SSRL) Enhancement will be located at the Stanford Synchrotron Radiation Laboratory. SSRL is colocated with the Stanford Linear Accelerator Center (SLAC) on Stanford University property that has been leased to the Department of Energy.

The SSRL Enhancement project will include the construction of new conventional and research facilities and the alteration of and additions to existing facilities for the purpose of providing ultra-high brightness synchrotron radiation from insertion devices (wigglers and undulators).

1. Title and location of project: Stanford Synchrotron Radiation Laboratory
Enhancement
Stanford Linear Accelerator Center
Stanford, California

2. Project No.: 84-ER-113

8. Brief Physical Description of Project (continued)

The project is divided into three major portions: (a) construction of two beam lines, one on the SLAC Positron Electron Project (PEP) storage ring and an 18 degree beam line on the Spear storage ring; (b) alteration of the electron storage ring SPEAR for high flux synchrotron radiation research and (c) construction of three conventional facilities: two PEP Beam Line Facilities and a Laboratory/Office/Shop Building (LOS).

a. Beam lines

(1) PEP Beam Lines

The PEP electron-positron storage ring is operated by the Stanford Linear Accelerator Center for the study of elementary particle physics. In its present configuration it can be usefully operated from 8 GeV to 18 GeV, although the majority of the program has focussed upon research at 14 GeV. During the normal running of the machine, the electron and positron beams emit synchrotron radiation from within the bending magnets with photon energies in excess of 100 KeV.

This project also includes funding for installation of two 26-period, 2-meter rare earth cobalt undulator magnets on a symmetry straight section of the PEP storage ring, resulting in the emission of photon beams peaked at 13 KeV when the machine is running at 14 GeV. Mossbauer diffraction and ultra-high energy resolution x-ray scattering research will be performed on these beam lines.

(2) Eighteen Degree Beam Line

To complement the high x-ray energy program on the PEP storage ring, SSRL proposes to construct a low-energy photon beam on the SPEAR storage ring, on the reinforced mezzanine in Bldg. 131. SSRL would relocate the existing Seya-Namioka monochromator from Beam Line I, and construct a new beam line transport system, consisting of two successive focussing mirrors.

1. Title and location of project: Stanford Synchrotron Radiation Laboratory
Enhancement
Stanford Linear Accelerator Center
Stanford, California

2. Project No.: 84-ER-113

8. Brief Physical Description of Project (continued)

b. Machine Improvements

(1) Reduction of SPEAR Emittance and Vertical Aperture Requirements

To obtain approximately an order of magnitude increase in spectral brilliance from all beam lines and to more effectively utilize insertion devices, the injection system and the electron optics of the storage ring will be modified. This will achieve a factor of approximately 3.5 reduction in horizontal emittance and a factor of approximately two reduction in vertical aperture requirements at wiggler and undulator locations.

To accomplish the proposed reduction in emittance, SSRL has initiated the design and fabrication of a current shunt for the four focussing magnets located between the injection kicker magnets, using FY 1983 R&D operations funds. SSRL will also complete the shunt and injector modifications, and modify the SPEAR sextupole powering system. At present, the SPEAR sextupole magnets are divided into two families, each of which is powered independently. To properly correct for chromaticity effects in low emittance configurations, the SPEAR sextupole magnets need to be divided into four independently powered families. This requires two additional power supplies and additional cabling.

Realization of the full benefits of the reduced emittance and reduced vertical aperture requirement requires an improved beam position monitoring system for the storage ring. Improved monitoring and control over the orbit will result in reduced cross-coupling and better steering of the SSRL synchrotron radiation beams.

In addition, modifications and additions will be made to the SPEAR lattice to facilitate compensation for the increased number of wiggler/undulator magnets that will be implemented in the future.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Stanford Synchrotron Radiation Laboratory Enhancement
Stanford Linear Accelerator Center
Stanford, California

2. Project No.: 84-ER-113

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8. Brief Physical Description of Project (continued)

(2) Beam Stabilization

At present the stored beam in SPEAR is perturbed by ground vibrations which couple into the SPEAR magnet supports, causing small amplitude, low frequency (4-12 Hz) oscillations of the electron beam. The effect of this is to cause vertical bouncing of the synchrotron radiation beams and intensity modulation of the flux transmitted through narrow slits at the experimental stations.

The present level of "beam bounce" will be reduced by making use of electronic feedback systems to detect and reduce the amplitude of the beam bounce by applying magnetic corrections to the orbit at each beam line source point.

(3) New Linac Electron Injection System

The American University proposal to construct a new electron gun and injection system will be funded in FY 1984. This gun is designed to produce high current, long pulse length (approximately 1 microsecond) beams of low energy electrons suitable for use in a nuclear physics research program.

SSRL funded the addition of a "chopper" to the gun in order for the injection system to have the capability for producing short pulses (of about 1 nanosecond in duration). This addition will allow the gun to provide low current beams, up to about 4 GeV, suitable for electron injection into SPEAR. A gun with this capability will be advantageous for use during SSRL dedicated operation of SPEAR since it can provide more reliable injection into SPEAR at somewhat lower operations costs It will also allow dedicated operation of SPEAR during parts of SLAC's summer shutdowns.

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1. Title and location of project: Stanford Synchrotron Radiation Laboratory Enhancement
Stanford Linear Accelerator Center
Stanford, California

2. Project No.: 84-ER-113

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8. Brief Physical Description of Project (continued)

c. Conventional Construction

(1) PEP Beam Line Facility 5B (PBF 5B)

The site at PEP has been chosen for the first PEP Beam Line and the associated facility. The site is just within the existing SLAC lease boundary and it will not be necessary to acquire more land from the University for the facility. The site requires a retaining wall for the access road, service yard and PBF building which will be half buried into the PEP ring earth shielding mount.

The PBF 5B will be an experimental hall with three adjoining rooms and a partial mezzanine. The hall and room areas will be 2,900 square feet; the mezzanine will be 600 square feet, for a total of 3,500 square feet.

(2) PEP Beam Line Facility 1B (PBF 1B)

The site at PEP has been chosen for the second PEP Beam Line and the associated facility. The site also requires a retaining wall for the access road, service yard and PBF building which will be three-fourths buried into the PEP ring earth shielding mount.

(3) Laboratory/Office/Shop Building (LOS)

The Laboratory/Office/Shop Building (LOS) will be a three-story, 31,500 gross square feet building designed to accommodate activities displaced by beam lines in the existing SSRL buildings, as well as laboratory growth associated with SEP and other SSRL construction programs.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Stanford Synchrotron Radiation Laboratory
   Enhancement
   Stanford Linear Accelerator Center
   Stanford, California

2. Project No.: 84-ER-113

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8. Brief Physical Description of Project (continued)

The first floor will consist of a Vacuum Clean Room, a Beam Line Component Assembly Shop, a Machine and Welding Shop, and machine shop offices and storage facilities.

The second floor will consist of six light laboratories, each 1800 gsf in size, with the following functions, respectively: 1) electronics, 2) computation, 3) biotechnology, 4) vacuum-ultraviolet research, 5) metrology and 6) x-ray research. Provision will be made for later addition of two chemical fume hoods and two toxic/acid waste disposal systems.

The third floor will provide up to 43 offices, a library, a conference room, a drafting room, a lounge-lecture area, and seven work rooms.

9. Purpose, Justification of Need for, and Scope of Project

Over the past decade, the development of synchrotron radiation has led to major advances in a number of different scientific and technological fields, but particularly materials science, condensed matter physics and chemistry, as well as the biological sciences. Each order of magnitude increase in photon flux or spectral brilliance achieved during this period has resulted in qualitatively new experiments which provide previously unobtained information and yield new understandings.

The most significant recent advances in photon flux and brilliance have been, or will be, the result of: (a) the development of insertion devices (wigglers and undulators) at SSRL and (b) improvements in storage ring characteristics (reduction of emittance and increases in current).

As a result, new storage rings are presently being planned which are optimized for high spectral brilliance and photon flux through utilization of insertion devices, rather than bending magnets, for the production of radiation

1. Title and location of project: Stanford Synchrotron Radiation Laboratory Enhancement
Stanford Linear Accelerator Center
Stanford, California

2. Project No.: 84-ER-113

9. Purpose, Justification of Need for, and Scope of Project (continued)

and through the achievement of extremely low emittances and high currents. These rings are also optimized for specific spectral regions through choice of stored electron energies. Generally, stored electron energies at 1.0 to 1.5 GeV are utilized for ultra-high brilliance soft x-ray and vacuum ultraviolet (VUV) generation whereas rings of greater than 3.0 GeV are used for ultra-high brilliance x-ray generation.

The SSRL improvements described here will rapidly and economically yield major increases in the photon flux and spectral brilliance available at SSRL in all spectral ranges. In addition, x-ray spectral brilliance far beyond those achieved or proposed elsewhere in the world will be obtained. The SSRL construction will also increase the time available for dedicated synchrotron radiation operation of the storage ring SPEAR and increase the effectiveness of utilization of the radiation. At the same time, it will provide for testing and development of individual insertion devices as well as the techniques for utilizing many insertion devices on one storage ring.

The existing Stanford Synchrotron Radiation Laboratory has outstanding user facilities that can be dramatically and quickly improved in the hard x-ray region, thereby providing researchers with unparalleled photon brightness over an extended portion of the electromagnetic spectrum. A past 100-fold improvement to SSRL intensity in the soft x-ray region involved the installation at SPEAR of a permanent magnet undulator conceived and built at LBL. A current LBL/SSRL collaboration will provide a 50-fold improvement over the entire energy range based on an LBL-developed wiggler. Therefore, it is logical to continue joint activities to further improve SSRL facilities as a cost-effective way of providing researchers with additional advanced tools to complement those available elsewhere.

This project will be constructed at the Stanford Linear Accelerator Center which is non-Government owned property.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Stanford Synchrotron Radiation Laboratory Enhancement
Stanford Linear Accelerator Center
Stanford, California

2. Project No.: 84-ER-113

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10. Details of Cost Estimate

	Item Cost	Total Cost
(a) Engineering, design, and inspection..................	1,899	
(b) Construction costs................................	8,367	
(c) Standard equipment................................	308	
(d) Removals and relocations..........................	100	
(e) Contingencies at approximately 19% of above.........	2,159	
Total estimated costs..		$ 12,833

11. Method of Performance

The SSRL special facilities engineering design will be done by Laboratory (SSRL and SLAC) personnel, as will major technical component construction and assembly. Technical component construction and fabrication will be done by a combination of SLAC shops and by subcontracts awarded on the basis of competitive bidding and managed by SSRL and SLAC personnel.

Conventional facilities engineering design will be performed partially under a negotiated Architect/Engineer subcontract, but primarily by the SLAC Plant Engineering Dept. on a "best efforts" basis. Inspection and some engineering will be done by Laboratory personnel. Construction and procurement will be accomplished by fixed-price subcontracts awarded on the basis of competitive bids.

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1. Title and location of project: Stanford Synchrotron Radiation Laboratory Enhancement
Stanford Linear Accelerator Center
Stanford, California

2. Project No.: 84-ER-113

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12. Funding Schedule of Project Funding and Other Related Funding Requirements

	FY 1984	FY 1985	FY 1986	FY 1987	Total
a. Total facility construction costs: a/					
SSRL Enhancement	$ 544	$ 2,661	$ 5,160	$ 4,468	$ 12,833
Total facility construction cost..........	544	2,661	5,160	4,468	12,833
b. Other project funding:					
SSRL R&D..................................	800	800	0	300	1,900
Total R&D/Startup.........................	800	800	0	300	1,900
Total Project Funding.....................	$ 1,344	$ 3,461	$ 5,160	$ 4,468	$ 14,733

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Related Funding Requirements

a. Total Project Funding

(1) The major elements of the SSRL Enhancement Project have been described in item 8.

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a/ Includes escalation to midpoint of construction for all conventional facilities and compounded annually for special facilities; FY 1984 N/A; FY 1985 6.2%; and FY 1986 $6.5%.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Stanford Synchrotron Radiation Laboratory
Enhancement
Stanford Linear Accelerator Center
Stanford, California

2. Project No.: 84-ER-113

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13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements (continued)

The funding profiles were determined as follows:

(a) At SSRL the PEP Beam Line will be accomplished during the first two years. Improvements to SPEAR are scheduled for the second year and the Laboratory/Office/Shop Building is scheduled for the second and third year. Completion of the PEP Beam Line Facility 1B will occur in the third year, and completion of the PEP Beam Line 1B will occur in the fourth year.

(2) Other project funding

(a) Insertion Devices and Beam Line Optical Elements R&D activities include in-vacuum undulators, and advance beam line components suitable for ultra high brilliance photon beams.

(b) SSRL R&D is related in support of the construction project includes prototype development and R&D on technical components.

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CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
BASIC ENERGY SCIENCES
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Kansas State University, Ion Collision Physics Facility, Manhattan, Kansas

2. Project No.: 85-ER-403

3. Date A-E work initiated: 1st Qtr. FY 1985

3a. Date physical construction starts: 2nd Qtr. FY 1985

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: $3,400

6. Current cost estimate: $5,028

Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1985	$ 2,000	$ 2,000	$ 2,000	$ 100
1986	1,828	1,828	1,828	928
1987	1,200	1,200	1,200	2,100
1988	0	0	0	1,900

Financial schedule is based on the net Government funding associated with this project. In May 1985, the State of Kansas Legislature appropriated $1,100,000 for the conventional construction necessary to house the new capabilities.

8. Brief Physical Description of Project

The James R. MacDonald Laboratory will be expanded to house a new booster accelerator and a new low energy highly charged ion source. A 9,000 square foot basement addition will be required to house these facilities. The additional power requirement is 100 KVW. Very little additional water for cooling will be required.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Kansas State University, Ion Collision Physics Facility, Manhattan, Kansas

2. Project No.: 85-ER-403

8. Brief Physical Description of Project (continued)

New equipment to be installed in new basement addition includes:

A. Cryogenic ion source including electron gun, superconducting solenoid magnet. Analyzing magnet, accelerating column and beam line apparatus.

B. Superconducting linear accelerator includes resonators, amplifiers, power supplies, RF control system, superconducting solenoids, liquid nitrogen system, liquid helium refrigerator and storage dewar, accelerator control computer system, data acquisition and data reduction computer system.

9. Purpose, Justification of Need for, and Scope of Project

The construction of the ion collision physics facility, together with the existing atomic physics capability at Kansas State University, will constitute the Institute for Atomic Collision Physics. The project will involve construction and installation of (1) an advanced source of low energy highly charged ions of the CRYEBIS type and (2) a LINAC booster comprising twelve superconducting split-ring resonators. Each of these two additions will function as an adjunct to the existing tandem Van de Graaff in ways that, along with a dedicated system for high speed computation and data analysis, will have the capability to study the atomic physics of a spectrum of ions, energies and intensities unmatched in the world. This will open new areas of atomic collision physics, allow long beam time experiments, and provide a forefront environment for training young scientists and encouraging interdisciplinary cross-fertilization.

This project will be constructed on the Kansas State University campus, non-Government owned property.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Kansas State University, Ion Collision Physics Facility, Manhattan, Kansas

2. Project No.: 85-ER-403

10. Details of Cost Estimate

	Item Cost	Total Cost
a. Engineering, design and installation		$ 980
b. Land and level rights		0
c. Construction costs		330
1) beam line construction	$ 315	
2) utilities	15	
3) buildings	a/	
d. Equipment		2,900
e. Contingency		818
Total Project Cost		$ 5,028 a/

11. Method of Performance

This type of construction is unique and therefore the conceptual design, final design, assembly, and testing will be done by the staff of Kansas State University. Component parts equipment and building construction will to the extent possible be based on fixed priced competitively obtained procurement actions.

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a/ Kansas State University has provided additional funding to construct the building. Estimate is based on completed conceptual design.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Kansas State University, Ion Collision Physics Facility, Manhattan, Kansas — 2. Project No.: 85-ER-403

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	FY 1985	FY 1986	FY 1987	FY 1988	Total
a. Total project funding					
(1) Total facility costs					
(a) Construction line item	$ 100	$ 928	$ 2,100	$ 1,900	$ 5,028 a/
(b) CP&D	0	0	0	0	0
(c) Expense funded equipment	0	0	0	0	0
(d) Inventories	0	0	0	0	0
Total facility costs	$ 100	$ 928	$ 2,100	$ 1,900	$ 5,028 a/
(2) Other project funding					
(a) R&D necessary to complete construction	$ 180	$ 180	$ 50	$ 0	$ 410
(b) Other	0	0	0	0	0
Total other project funding	180	180	50	0	410
Total project funding	$ 280	$ 1,108	$ 2,150	$ 1,900	$ 5,438 b/

b. Related annual funding requirements (estimated life of project: 20 years)

(1) Operating costs	$ 0
(2) Programmatic operating expenses	600
(3) Capital equipment not related to construction but related to the programmatic effort in the facility	50
(4) GPP or other construction related to programmatic effort in the facility	0
(5) Other costs	0
Total	$ 650

13. Narrative Explanation of Total Project Funding and Other Related Requirements

No narrative required.

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a/ Kansas State University has provided additional funding to construct the building. Estimate is based on completed conceptual design.

b/ As noted above, the State of Kansas has provided an additional $1,100,000 for conventional construction of housing.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
BASIC ENERGY SCIENCES
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: General plant projects

2. Project No.: 87-R-400

3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 2nd Qtr. FY 1987

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: None
Date:

6. Current cost estimate: $4,080
Date: January 1986

7. Financial Schedule:

		Costs			
Fiscal Year	Obligations	FY 1985	FY 1986	FY 1987	After FY 1987
Prior Year Projects	$ 400	$ 167	$ 0	$ 0	$ 0
FY 1985 Projects	3,750	2,015	1,735	0	0
FY 1986 Projects	3,877	0	847	3,030	0
FY 1987 Projects	4,080	0	0	470	3,610

8. Brief Physical Description of Project

This project is required to provide for minor new construction, other capital alterations and additions, and for buildings and utility systems. Where applicable, the request also includes the cost of installed capital equipment integral to a subproject. Funding of this type is essential for maintaining the productivity and usefulness of Department-owned facilities. Since it is difficult to detail this type of project in advance, a continuing evaluation of requirements and priorities may be expected to result in additions, deletions, and changes in the currently planned subproject. In general, the estimated funding for each location is preliminary in nature, and is intended primarily to indicate the relative magnitude of the requirements. No significant R&D program is anticipated as a prerequisite for design and construction of the subprojects under construction.

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1. Title and location of project: General plant projects

2. Project No.: 87-R-400

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8. Brief Physical Description of Project (continued)

The currently estimated distribution of FY 1986 funds by office is as follows:

Argonne National Laboratory	$ 3,000
Ames Laboratory	600
Notre Dame Radiation Laboratory	30
Sandia National Laboratories	300
Stanford Synchrotron Radiation Laboratory	150
Total project cost	$ 4,080

9. Purpose, Justification of Need for, and Scope of Project

The following are examples of the major items to be performed at the various locations. Since needs and priorities may change, other projects may be substituted for the examples listed below, and some of these may be located on non-Government owned property.

Argonne National Laboratory	$ 3,000

1. Materials Handling Receiving/Shipping Building
2. Replace Post Indicator Valves
3. Install Standby Power Feed, ZPPR to Bldg. 752
4. RSWF Road Rebuilding
5. Rigging Test Facility Addition
6. Security System Upgrading
7. Upgrade Animal Facility Cooling E and Q Wings, Bldg. 202
8. Chiller and Unit Substation Replacement, Bldg. 205
9. 15kV Undergound Valut Switch Replacement, Bldg. 211
10. Transformer and Power Center Replacement, Bldg. 203
11. Replace Economizer Tubes of Boiler No. 5
12. Building 201 Improvements
13. Emergency Generator Replacement, Bldg. 350

1. Title and location of project: General plant projects

2. Project No.: 87-R-400

9. Purpose, Justification of Need for, and Scope of Project (continued)

14. Replace Air Compressors, Bldg. 211
15. Rehabilitate Washrooms and Locker Roomms, Bldgs. 301, 308 and 310
16. 15kV Underground Vault Switch Replacements, Bldg. 205
17. Upgrade of Electrical Service Laboratories, Bldg. 223
18. Cooling System Upgrade, Bldg. 203
19. Air Condition Hot Shop, Building 212
20. Lecture Room Improvement, Bldg. 221
21. Test Instrument Room for EBR-II Sodium Boiler Bldg.
22. Laboratory Renovation Lab, J-102, Bldg. 205
23. Upgrading of the Tandem-Linac Area, Phase IV, Bldg. 300
24. HFEF/S Backup Emergency Power Supply
25. Expansion of Instrument Test Facility (ITF) Bldg. 772

Of the total request of $3,000,000 for GPP at the Argonne National Laboratory approximately 50 percent will be used for plant rehabilitation and approximately 50 percent will be used for upgrading and programmatic projects.

At present, a total documented GPP backlog of approximately $20,000,000 exists at ANL for required upgrading and programmatic projects at both sites. This backlog is not static and is constantly under review by ANL management so that the most critical requirements are taken care of as promptly as possible with available GPP funding. These requirements may come about as the result of the unscheduled failure of major plant components or the need to satisfy scientific program requirements.

The backlog of GPP projects has tended to increase steadily in recent years due to the shortfall in funding line item requests for plant rehabilitation at ANL-East and ANL-West, and because of programmatic shifts at ANL which have required modifications to the existing plant. When it is considered that total GPP funds available to ANL in FY 1983 and FY 1984 total only $2,100,000, it is readily apparent that while funding was increased ANL needs still far outpace the availability of funds with which to satisfy them.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: General plant projects

2. Project No.: 87-R-400

9. Purpose, Justification of Need for, and Scope of Project (continued)

Ames Laboratory.. $ 600

Requirements include for example: development building second floor addition, campus warehouse roof replacement, metallurgy building electrical system upgrade, water system upgrade and miscellaneous proejcts. The projects described will be constructed on the Ames Laboratory, non-Government owned property.

Notre Dame Radiation Laboratory.. $ 30

Requirements include minor building modifications to properly house staff members and to make optimum use of laboratory research space. The projects described will be constructed on the Notre Dame Radiation Laboratory, non-Government owned property.

Sandia National Laboratories.. $ 300

The Combusion Research Facility (CRF) at Sandia National Laboratories, Livermore (SNLL) has a continuing need for General Plant Project (GPP) funds for upgrading or the construction of facilities as required to meet expanding or changing programmatic goals.

Many experiments, both active and proposed, at the CRF have greatly impacted the available laboratory space and facilities. Some experiments have become increasingly complex and consequently require larger laboratory space than is currently available to them. The GPP funding in this request will provide additional laboratory space with appropriate modifications to suit individual experimental situations.

Stanford Synchrotron Radiation Laboratory...................................... $ 150

Requirements include minor modifications and additions necessary to support the optimum use of the laboratory research space. Examples include cable trays, terminal racks, status panels, and similar improvements.

10. Details of Cost Estimate

See description, item 8. The estimated costs are preliminary and, in general indicate the magnitude of each program. These costs included engineering, design, construction and inspection.

CONSTRUCTION PROJECT DATA SHEETS

I. Title and location of project: General plant projects

2. Project No.: 87-R-400

II. Method of Performance

Design will be on the basis of negotiated architect-engineer contracts. To the extent feasible, construction and procurement will be accomplished by firm fixed-price contracts and subcontracts awarded on the basis of competitive bidding.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
BASIC ENERGY SCIENCES
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Accelerator and reactor improvements and modifications, various locations

2. Project No.: 87-R-401

3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 1st Qtr. FY 1987

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: None
Less amount for CP&D: None
Net cost estimate: None
Date: January 1986

6. Current cost estimate: $2,883
Less amount for CP&D: 0
Net cost estimate: $2,883

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1987	$ 2,883	$ 2,883	$ 2,883	$ 1,000
1988	0	0	0	1,333
1989	0	0	0	550

8. Brief Physical Description of Project

This project provides for additions and modifications to accelerator and reactor facilities, which are supported by the Basic Energy Sciences program. Since program priorities and needs change, the projects described below indicate the most likely projects to be funded. A continuing evaluation, however, is necessary to ensure that those projects with the greatest productivity are funded. Two projects at the Brookhaven National Laboratory are requested to incorporate improvements at the High Flux Beam Reactor and the National Synchrotron Light Source; two projects are requested at the Oak Ridge National Laboratory for improvements at the High Flux Isotope Reactor and the Holifield Ion Research Facility, and one project is requested for an enhanced injection system at the Stanford Synchrotron Radiation Laboratory.

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1. Title and location of project: Accelerator and reactor improvements and modifications, various locations

2. Project No.: 87-R-401

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9. Purpose, Justification of Need for, and Scope of Project

The following are the projected items of work to be performed at the various locations. Since needs and priorities may change, other projects may be substituted for the examples listed below, and some of these may be located on non-Government owned property.

Brookhaven National Laboratory

High Flux Beam Reactor Facility (HFBR).. $ 940

The control room recorders are becoming obsolete. Increased maintenance and unavailability of spare parts for the present system are two factors which contribute to the need for updated recorders. The control room recorders will be replaced with modern recorders which will reduce maintenance requirements, provide better timing accuracy and have capability for both analog and digital output.

The existing fuel element cutting system requires continual maintenance which results in unnecessary radiation exposure, inefficient use of maintenance personnel, and a system of less than desirable operating efficiency. A new system will be designed to eliminate the deficiencies of the present system and provide a simple and effective method of cutting spent fuel elements in the fuel storage canal.

An automated method of treatment will be installed for controlling biological fouling in the secondary system for the HFBR reactor.

The present HFBR turbines are not optimized to the existing workload conditions of helium pressure and mass flow. New turbines of appropriate design will improve the efficiency of the refrigerator, reduce power consumption and lengthen the expected life of the system components.

There is a need for a second compressor at the Cold Neutron Facility (CNF) in order to provide redundancy and assure continuity of operation. If the present compressor has to be removed from service for any reason, the

1. Title and location of project: Accelerator and reactor improvements and modifications, various locations

2. Project No.: 87-R-401

9. Purpose, Justification of Need for, and Scope of Project (continued)

facility must be shut down, with the attendant loss to the solid state physics and biology programs. The new compressor would not need to be as large as the old compressor (400 hp instead of 600 hp) since the loads are not as great as originally expected; this would result in some savings in electrical power consumption. A small building with a concrete mounting pad is included to house the new compressor.

Human error has been a factor in venting and purging of the CNF causing down time and programmatic delays. Improvements to the CNF console would include changing the layouts, making displays more compact and legible, and adding a computer to log operating procedures, thereby reducing downtime.

Instrumentation, equipment, and other reactor modifications are required for safeguards and security directly related to HFBR for protection against theft, radiation leakage, or sabotage of nuclear fuel storage and transfer.

National Synchrotron Light Source (NSLS).. $ 1,515

The linear accelerator preinjector will be replaced by a new state-of-the-art injector of higher performance, higher energy, and better reliability and maintainability.

The system of hardware which connects the control compiler system to hardware devices such as power supplies, beam diagnostic equipment, and safety interlocks, will be replaced with up-to-date equipment.

In addition to the 50 MHz rf system, the VUV ring rf system will be complimented with a 500 MHz rf system for making fractional nanosecond duration bunch lengths such as are desired in various experiments.

The pulsing power supplies of the booster synchrotron will be replaced with new units of improved stability and capable of operating at higher repetition rates.

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1. Title and location of project: Accelerator and reactor improvements and modifications, various locations

2. Project No.: 87-R-401

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9. Purpose, Justification of Need for, and Scope of Project (continued)

Oak Ridge National Laboratory

Holifield Heavy Ion Research Facility (HHIRF).. $ 300

The atomic physics program at ORNL supports the national effort in basic atomic collisions research and its application to energy technology. This project is designed to increase the utility of the Holifield Heavy Ion Research Facility (HHIRF) for atomic physics and is part of a continuing program to provide for those improvement which have been identified as having the highest priority.

Experiments conducted in the ORNL EN-tandem require extension to the higher energies available from the HHIRF facility. The wide energy overlap available between these two accelerators, plus the fact that the EN accelerator reaches to energies much lower than those attainable with the HHIRF accelerators, provide a highly flexible accelerator complex. The experimental apparatus proposed here will enable us to exploit the unique capabilities of this accelerator complex. The experimental apparatus proposed here will enable us to exploit the unique capabilities of this accelerator complex.

Ames Laboratory

Ames Research Reactor... $ 128

Provides funds for modifications to the Ames Research Reactor, which will make this space usable for laboratory research.

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1. Title and location of project: Accelerator and reactor improvements and modifications, various locations

2. Project No.: 87-R-401

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9. Purpose, Justification of Need for, and Scope of Project (continued)

10. Details of Cost Estimate

a. High Flux Beam Reactor Facility	$ 940
b. National Synchrotron Light Source	1,515
c. Holifield Heavy Ion Research Facility	300
d. Ames Research Reactor	128
Total Project Cost	$ 2,883

11. Method of Performance

Design, engineering, and inspection will be performed by laboratory staff. To the extent feasible, construction and procurement will be accomplished by fixed-price subcontracts awarded on the basis of competitive bidding.

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1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
BASIC ENERGY SCIENCES
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Neutron scattering experimental hall,
Los Alamos Neutron Scattering Center (LANSCE)
Los Alamos, New Mexico

2. Project No.: 87-R-403

3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 1st Qtr. FY 1987

4. Date construction ends: 2nd Qtr. FY 1989

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $ 17,500
Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1986	a/	a/	a/	a/
1987	$ 5,000	$ 5,000	$ 5,000	$ 4,600
1988	8,500	8,500	8,500	7,900
1989	4,000	4,000	4,000	5,000

8. Brief Physical Description of Project

This project provides for the addition of an experimental hall, support space, and associated facilities to the Los Alamos Neutron Scattering Center (LANSCE) to allow full use of what will be the nation's most intense pulsed neutron source with the completion of the Proton Storage Ring (PSR). The unique vertical orientation of the proton beam as it strikes the neutron-generating target allows neutron drift tubes to be arranged in a full 360^{o} circle permitting experiments to be arranged in all directions around the source. The proposed experimental hall will provide the additional space required to fully utilize this powerful source for a national neutron scattering program at LANSCE.

a/ Funding in the amount of $1,000,000 was appropriated by the Congress in FY 1986 in the Atomic Energy Defense Appropriation with instructions that future Appropriations were to be requested in the Energy Supply Appropriations.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Neutron scattering experimental hall,
Los Alamos Neutron Scattering Center (LANSCE)
Los Alamos, New Mexico

2. Project No.: 87-R-403

8. Brief Physical Description of Project (continued)

The experimental hall will be an 18,000 square foot pre-engineered high-bay structure on a concrete slab attached to the east side of the LANSCE facility. This structure will house a minimum of nine experiments on nine flight paths. Two of the flight paths can be extended as far as 300 meters outside the hall for ultra-high resolution experiments. An overhead crane with a 20 foot hook height will provide access to both the experiments and the service area. The hall will be equipped with a full complement of services required for multiuse experiments, including special grounds, extension signal cable, easy access to several power distribution systems, process cooling water, compressed air, and inert gas distribution systems. An access channel into the existing LANSCE experimental area suitable for forklift trucks will be provided.

Ventilation and heating for the experimental hall will be a recirculating forced-air system with heat provided by the existing hot water service. Plumbing and piping system will consist of gas, potable hot and cold water, industrial water, sanitary sewer, contaminated liquid waste drain, cooling tower water, and compressed air. Fire protection will be provided through a wet-pipe sprinkler system and alarms. Existing site utility systems, except for the sewage system, have adequate capacity.

An approximate 22,800 square foot three-story building directly attached to the hall will also be constructed. This building will house the new data acquisition system, mechanical and electronic shops, sample preparation laboratories, cryogenic laboratories, and offices for users and personnel directly associated with the operation of the user program at the LANSCE.

Only minimal site preparation will be required for the experimental hall after an existing detector building is relocated. The site will be essentially clear and at the same elevation as the existing LANSCE experimental area. A new 1500-kVA substation and an increase in sewage treatment capacity at the existing lagoons will be required. The present hall will be renovated by adding two new access doors, by installing a catwalk system, and by drilling five new shielding penetrations for new neutron beamlines. Special facilities for nuclear physics studies will be removed from the existing experimental hall and reestablished elsewhere to provide more space and independent operation for the neutron scattering programs.

1. Title and location of project: Neutron scattering experimental hall,
Los Alamos Neutron Scattering Center (LANSCE)
Los Alamos, New Mexico

2. Project No.: 87-R-403

8. Brief Physical Description of Project (continued)

The project includes funding for construction of four new spectrometers specially designed to make optimum use of the intense pulsed neutron beam. These will be in addition to six world class spectrometers, built and tested at LANSCE prior to construction of this experimental hall, that will be installed in the new experimental hall. Present plans include one spectrometer for each beam hole, although as many as two per beam hole are often feasible. In addition to the ten spectrometers discussed above, new spectrometer development and other experiments will be conducted on five other beam lines. Altogether, the neutron scattering program will have fifteen beam lines available when full facility operation is reached - ten operating world class spectrometers along with five other beam lines for future spectrometer locations.

The project also includes funding for six data collection computers of advanced design and a hub computer for data reduction, storage and manipulation. Time-of-flight experiments with the PSR are expected to collect an enormous amount of data (approximately 1 million resolution elements per instrument) at very high instantaneous data rates (up to 20 MHz expected). On-line data reduction will be essential so that raw data can be transformed into physical terms, displayed with high-quality graphics, thereby allowing on-line decisions on the progress of the experiments. Peak data rates with the PSR will be 400 times current levels and time average data rates will be 40 times current levels. We will continue to use four of the computers now in service so that ten experiments can run simultaneously with independent data collection systems when the facility is complete. These four existing computers will be replaced gradually after FY 1986 with advanced systems incorporating the latest in computer improvements. Funds for these four replacement computers be provided in later years.

9. Purpose, Justification of Need for, and Scope of Project

The LANSCE facility, which is now in operation, is a neutron time-of-flight laboratory devoted to neutron scattering research in materials science and neutron nuclear science research. The research is applied to problems of significance to the nation's energy and defense programs and also contributes to the pool of basic knowledge underlying materials and nuclear science. The experimental program, which is well underway using the existing LANSCE spallation source, covers a wide variety of condensed matter research. The program also includes research into improved

1. Title and location of project: Neutron scattering experimental hall,
Los Alamos Neutron Scattering Center (LANSCE)
Los Alamos, New Mexico

2. Project No.: 87-R-403

9. Purpose, Justification of Need for, and Scope of Project (continued)

spectrometers and neutron source design that will allow the optimum use of pulsed neutrons. This research program has been planned so that it can continue and can grow throughout the period of construction of the PSR and the proposed experimental hall. The original plan for the existing experimental hall did not contemplate the 100 fold increase in neutron source capability to be made available by the PSR. This greater intensity and optimized pulse structure from the PSR transformed the source into clearly the best spallation neutron source in the nation and perhaps in the world. The extraordinary capabilities have proved attractive not only to the Los Alamos National Laboratory staff, but to a large contingent of the nation's best researchers from universities and from industry. The increasing flow of visiting experimenters is being organized into a user group that began operation formally in May 1983. Proposals for experiments at Los Alamos from this user group are submitted to an external panel of reviewers. These external reviewers will plan the use of 2/3 of the beam time available on the established spectrometers. Presently, the reviewers receive requests for three times as much experimental time as the facility can provide. Soon after the PSR becomes operational, the Laboratory expects to host approximately 100 visitors each year.

The requested experimental hall will provide adequate experimental areas to accommodate the user community and will permit the full use of the neutron source for material science research. Space is included ultimately for as many as 15 spectrometers with enough room between so that neighboring experiments do not interfere with each other. It includes space located at longer distances from the source that permits full exploitation of advances in resolution made possible by the source. Room for staging of experiments and for preparation of samples in special environments is included within the experimental hall. Also, the hall is provided with an overhead crane that allows equipment to be transported over all of the experimental and staging areas. Sound conditioned or "quiet" rooms are located adjacent to the experimental floor for the use of experimenters in evaluating and planning the next step in an active experiment.

1. Title and location of project: Neutron scattering experimental hall,
Los Alamos Neutron Scattering Center (LANSCE)
Los Alamos, New Mexico

2. Project No.: 87-R-403

9. Purpose, Justification of Need for, and Scope of Project (continued)

Since data collection rates for many experiments at LANSCE will be orders of magnitude greater than encountered at present facilities, it is necessary that at least half of our spectrometers have forefront computerized data collection and analysis systems when the PSR becomes operational. This system will make possible the operation of experiments at full performance levels and also will greatly speed the interpretation of the results of the experiments. State-of-the-art data collection and handling facilities are of great importance to visiting scientists who must complete experiments and interpret them during very short visits probably lasting on the average of about one week. These computers will therefore ensure that the LANSCE facility will have its greatest impact in strengthening the national position in materials science through the visitor program. Data acquisition for other spectrometers designed for slower data rates (small samples, ultra-high resolution) will use computers now in service at the LANSCE and will be replaced out of the annual Laboratory equipment budget allocation in accordance with the needs and funding level of the developing LANSCE program.

In summary, the combined floor space of the existing and proposed experimental hall of 22,500 square feet will more than quadruple the space available for spectrometers and staging of experiments thus assuring full use of the source intensity for the national neutron scattering program. The support area will provide space for data collection, light technician service, and for visiting users and facility support staff. The six data collection systems will assure that adequate computer facilities will be available to service at least five spectrometers simultaneously at the extraordinarily high data rates needed for the higher intensity neutron scattering measurements. This additional experimental and support space is essential in order for the nation's materials science research community to take full advantage of the major advance in pulsed neutron intensity provided by the PSR.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project:	Neutron scattering experimental hall, Los Alamos Neutron Scattering Center (LANSCE) Los Alamos, New Mexico	2. Project No.: 87-R-403

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10. Details of Cost Estimate*

	Item Cost	Total Cost
a. Engineering, design, inspection** and project management		$ 1,450
1. Facility @ 11% of construction costs less Item B.3	$ 1,200	
2. Special equipment design at about 5% of Item B.3	250	
b. Construction costs		12,950
1. Improvements to land		
a. Site work including sand and filters	640	
2. Buildings		
a. East side laboratory and support offices, 22,800 sq. ft. @ $105/sq. ft.	2,400	
b. East experimental hall, 18,000 sq. ft. @ $168/sq. ft.	3,020	
c. Modify existing LANSCE experimental areas	2,080	
d. Relocate existing detector building	80	
3. Special equipment		
a. Computers	1,750	
b. Spectrometers	2,210	
4. Utilities including new substation	770	
c. Standard equipment including overhead cranes		500
Subtotal		14,900
d. Contingency @ 18%		2,600
Total estimated costs		$ 17,500

*The above cost estimate is based on a conceptual design that is complete. The Laboratory is using escalation rates of 4.9% for CY 1985, 6.4% for CY 1986, 6.7% for CY 1987 and 6.5% for 1988. These rates were provided by the "Data Resources Incorporated," under contract to the DOE.

**Engineering, design and inspection are projected from historical records and experience, then applied based on the complexity of the project.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Neutron scattering experimental hall,
Los Alamos Neutron Scattering Center (LANSCE)
Los Alamos, New Mexico

2. Project No.: 87-R-403

11. Method of Performance

Design and inspection of the facility additions will be accomplished by a negotiated architect-engineer contract. Special facility equipment design and procurement will be performed by the operating contractor. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts and contracts awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1987	FY 1988	FY 1989	Total
a. Total project funding					
1. Total facility costs					
a. Construction line item	$ 0	$ 4,600	$ 7,900	$ 5,000	$ 17,500
b. PE&D	0	0	0	0	0
c. Expense funded equipment	0	0	0	0	0
d. Inventories	0	0	0	0	0
Total facility costs	0	4,600	7,900	5,000	17,500
2. Other project funding					
a. Conceptual design	180	0	0	0	180
b. Other project-related costs	2,420	0	0	0	2,420
Total other project funding	2,600	0	0	0	2,600
Total project funding (Items 1 and 2)	$ 2,600	$ 4,600	$ 7,900	$ 5,000	$ 20,100

b. Related annual funding requirements (estimated life of project: 25 years)

1. Experimental hall operating costs	$ 600
2. Programmatic research expenses directly related to the DOE/BES neutron scattering program	5,400
3. Capital equipment not related to construction but related to the programmatic effort in the facility	500
4. GPP or other construction related to programmatic effort in the facility	0
5. Other Los Alamos program costs	4,100
Total	$ 10,600

1. Title and location of project: Neutron scattering experimental hall,
Los Alamos Neutron Scattering Center (LANSCE)
Los Alamos, New Mexico

2. Project No.: 87-R-403

13. Narrative Explanation of Total Project Funding and Other Related Requirements

- a. Total project funding
  - 1. Total facility
    - a. Construction line item. No narrative required.
    - b. No PE&D is anticipated.
    - c. No expense-funded equipment is anticipated.
    - d. No inventories are anticipated.
  - 2. Other project funding
    - a. The amount shown is for conceptual design. No research and development is necessary for this project.
    - b. Other projected-related costs. Six world class spectrometers will be built and tested prior to experimental halls construction and will become part of the facility upon completion of construction.
- b. Total related funding requirements
  - 1. Experimental hall operating costs
    This category includes maintenance, janitorial, and utilities calculated from FY 1984 costs on a per square foot basis throughout the Laboratory and projected to FY 1989. Approximately $600,000 per year is anticipated.
  - 2. Programmatic operating and research expenses directly related to the BES neutron scattering program is anticipated to be approximately $5,400,000 per year.
  - 3. Capital equipment not related to construction but related to the programmatic effort in the facility approximately $500,000 per year is anticipated.
  - 4. No GPP or other construction related to programmatic effort is anticipated.
  - 5. Other Los Alamos programs
    The Los Alamos National Laboratory will conduct internally-supported programs in neutron scattering and other research at an annual cost of $4,100,000.

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ENERGY SUPPLY RESEARCH AND DEVELOPMENT
BASIC ENERGY SCIENCES
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: 1-2 GeV Synchrotron Radiation Source
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-406

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3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: a/

4. Date construction ends: a/

5. Previous cost estimate: None

6. Current cost estimate: $ 1,500a/

Date: January 1986

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7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1987	1,500	1,500	1,500	1,500

8. Brief Physical Description of Project

The 1-2 GeV Synchrotron will be built within the Lawrence Berkeley Laboratory, which is located on University of California property adjacent to the Berkeley campus. The FY 1987 request is for A-E and long lead procurement to better define the cost, schedule and design prior to construction. (The estimated construction costs of the facility are projected at 90-100 million dollars with total R&D and startup costs of $25-30M.) The project will include the construction of new facilities, and alterations and additions to existing plant and site facilities, especially Building 6 (the circular building that now houses the 184-Inch Cyclotron). The 1-2 GeV Synchrotron is a special facility comprised of an electron storage ring and injection system, insertion devices (undulators and wigglers) for generating synchrotron radiation and photon beamlines. The facility consists of a 50-MeV injector, a full-energy booster synchrotron, an electron storage ring, which has 12 6-m-long straight sections for insertion devices, an initial complement of 5 insertion devices, and photon beamlines extending from the insertion devices. Development of 7 straight sections and 24 bending magnet ports are not included in the scope of this project. Their development in future years, however, will provide flexibility to respond to new scientific directions and to take advantage of new materials, designs, and other technological advances. When fully developed, the facility will be able to provide up to 60 user stations.

a/ The FY 1987 request provides for architect-engineering work and long lead procurement. The total estimated cost and exact construction dates of this project are currently under review.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: 1-2 GeV Synchrotron Radiation Source
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-406

9. Purpose, Justification of Need for, and Scope of Project

The 1-2 GeV Synchrotron Facility will be a dedicated synchrotron radiation source that is optimized for generating vacuum ultraviolet and soft x-ray (XUV) light from periodic magnetic devices. Investigators from industry, universities, and national laboratories will have access to unique capabilities--high spectral brilliance and very short pulse length (nominally tens of picoseconds). Multi-period undulators in the storage ring will provide spatially and longitudinally coherent radiation that is broadly tunable across the XUV region of the spectrum.

The 1-2 GeV Synchrotron will permit new studies in both basic and applied science. In **biology**, for example, the high photon flux combined with the capability for wavelength tuning, will enhance imaging and scattering techniques. Picosecond pulses and the ability to match soft x-rays to the absorption features of major structural biological elements, such as carbon, nitrogen, and oxygen, will make it possible to undertake dynamical response studies of specimens in something very close to their natural state. The coherence properties of undulator radiation will extend the use of synchrotron radiation into the phase-sensitive world of x-ray interferometry and biological microholography.

In **atomic** and **molecular physics**, very high photon fluxes are needed for spectroscopic studies of free atoms and molecules in the gas phase; with radiation from undulators and wigglers an acceptable signal-to-noise ratio can be obtained for many experiments in the x-ray region. The facility will introduce new standards for spectral resolution, and will provide access to new studies of atomic structure and dynamics, quantum interference effects, and threshold phenomena.

In **chemistry**, the facility will open new areas of research on chemical reactivity. High spectral brilliance and picosecond time structure of the radiation will permit high-resolution dynamical studies of reaction kinetics, intramolecular transfer processes, excited state proton and electron transfer, and molecular photodissociation and photoionization.

In **materials** and **surface science**, the capabilities of the 1-2 GeV Synchrotron will permit new investigations of bulk materials as well as surfaces and interfaces. Time-resolved studies in catalysis will be possible with XUV radiation of extremely high brilliance and picosecond time structure. For instance, it will be possible to study the dynamics of surface contamination and interface formation and to verify microscopic models for catalysis, oxidation, corrosion, and interface growth.

1. Title and location of project: 1-2 GeV Synchrotron Radiation Source
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-406

9. Purpose, Justification of Need for, and Scope of Project (continued)

Industrial utilization of XUV radiation will be stimulated by the availability of this radiation source, which can become a focal point for industrial-academic collaboration. One industrial application of radiation from the 1-2 GeV Synchrotron is improved mask fabrication for the microelectronics industry. By utilizing the full potential of synchrotron radiation for x-ray lithography, it will be possible to achieve finer feature sizes at less demanding aspect ratios, while competitive writing speeds are maintained.

In the area of **national security**, scientists at several national defense laboratories have expressed the need for access to a modern soft x-ray synchrotron radiation facility like the 1-2 GeV Synchrotron. They have emphasized dependable access to high-flux, high-brilliance facilities for program-related research.

These scientific opportunities are only a sample, indicating the potential for state-of-the-art synchrotron radiation research with the 1-2 GeV Synchrotron. The proposed facility will provide a much-needed addition to this country's oversubscribed synchrotron radiation sources, and will provide important new opportunities for student research and training in an area in which a lack of qualified personnel is already being felt. These scientific and educational opportunities have been well documented recently by national committees studying major research facilities needed to keep the United States scientifically competitive. These committees have consistently given the 1-2 GeV Synchrotron high priority. They include the DOE's Planning Study for Advanced National Synchrotron Radiation Facilities, the NRC's Major Materials Facilities Committee, and the DOE's ERAB Materials Facilities ad hoc Review Committee which reviewed the NRC report.

The 1-2 GeV Synchrotron will be available to general users as well as to participating research teams (PRT's). The Laboratory is determined to construct a user-friendly facility and has arrangements for users to play a significant role in determining the specification and design of the beamlines. Before commencing construction, LBL will conduct one more Users' Workshop to finalize operational parameters and organize beamline user teams. In addition, the 1-2 GeV Synchrotron has 7 additional straight sections and 24 ports on bending magnets that will be available for development by PRT's or for future facility enhancement by LBL to enable users to take advantage of new scientific opportunities or unforeseen technological developments. Realization of the full capabilities inherent in the 1-2 GeV Synchrotron configuration would result in support of up to 60 user stations.

1. Title and location of project: 1-2 GeV Synchrotron Radiation Source
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-406

10. Detail of Cost Estimate

The project provides funds for an Architect-Engineer to accomplish design sufficient to define the cost, schedule, and scope of the proposed facility. Also included are funds necessary for long lead procurement for those components which would limit the timely completion of the project. Early studies have been completed and it is anticipated that the TEC will be $90,000,000 to $100,000,000.

11. Methods of Performance

Conventional facilities engineering design will be performed under a negotiated Architect/Engineer subcontract.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	FY 1987	Total
a. Total project costs		
1. A-E costs	$ 1,500	$ 1,500
Total facility costs	1,500	1,500
2. Other project costs		
(a) Storage Ring R&D	1,000	1,000
(b) Insertion Device and Beamline R&D	500	500
(c) Startup	0	0
(d) Capital Equipment Related to R&D	500	500
Total other project funding	2,000	2,000
Total project funding	$ 3,500	$ 3,500

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: 1-2 GeV Synchrotron Radiation Source
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-406

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

The FY 1987 funding request for the project is for A-E design and long lead procurement necessary to fully define the cost, schedule, and cost of the proposed facility.

Site preparation and building construction for the 1-2 GeV Synchrotron Facility is scheduled for FY 1988-1989, in order that the building be ready for installation of the injector and the storage ring. Fabrication of the beamlines and insertion devices is scheduled for FY 1988-1991.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
ENERGY RESEARCH ANALYSIS
Energy Supply Research and Development - Operating Expenses

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs. Base
Energy Research Analysis					
Operating Expenses..	$ 2,970 a/	$ 2,598	$ 2,598	$ 3,550	$+ 952

a/ FY 1985 total does not include $30,000 transferred to the SBIR program.

Authorization: Section 209, P.L. 95-91.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST

SUMMARY OF CHANGES
Energy Research Analysis
(dollars in thousands)

FY 1986 Appropriation enacted..	$2,700
FY 1986 Gramm-Rudman reduction..	- 102
1986 adjusted..	2,598
Program increases and decreases:	
- Increased funding for FY 1987 National Acid Rain Assessment....	+550
- Increased funding for peer review............................	+402
1987 budget request..	$3,550

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer. (1)	General Reduction (2)	Management Initiatives (3)	Pay Cost Restoration (4)	FTE General Reduction (5)	Gramm-Rudman-Hollings (6)	ES&H Transfer/ Reprogramming (7)	Subtotal (8)	Comparability Adjustments (9)	Total (10)
Energy Research Analysis										
Operating Expenses	$ 2,700					$ -102		$ 2,598		$ 2,598
Subtotal, Energy Research Analysis	2,700					-102		2,598		2,598
General Reduction										
Management Initiatives										
Pay Restoration										
Use of Prior Year Balances (ERA)										
Use of Prior Year Balances (Other Energy Supply)										
Total, Energy Research Analysis	$ 2,700					$ -102		$ 2,598		$ 2,598

The Energy Research Analysis (ERA) program budget request is $3,550,000 and provides DOE with the capability for independent, objective analysis of the Department's technical needs and opportunities. ERA fulfills the Director of Energy Research's responsibility "to monitor the Department's Energy R&D programs in order to advise the Secretary with respect to any undesirable duplication or gaps in such program," Section 209(b)(2), Public Law 95-91. In addition, funding and staff are required to support technical assessment and coordination needs within the sharply increased interagency research relating to acid rain.

Recent Accomplishments

- Assessments of Departmental research during FY 1985 and FY 1986 include the following:
  - Assessment of research needs in Surface Coal Gasification technology (University of California)
  - Other research needs (JASON)
  - Assessment of research needs in Heavy Ion Fusion (Lawrence Berkeley Laboratory and others).
- Program assessments, important for establishing research objectives, recently accomplished were:
  - Assessment of the Geothermal research and technology development projects in Solar Renewables programs.
- Acid precipitation research coordination and liaison responsibilities for DOE with other Federal agencies were supported by the Energy Research Analyses program and included the following specific efforts:
  - Preparation of the 1985 Assessment of the National Acid Precipitation Assessment Program (Oak Ridge National Laboratory, Brookhaven National Laboratory, et. al.).
  - Assessment of research needs in acid precipitation (Brookhaven National Laboratory, Oak Ridge National Laboratory, Pacific Northwest Laboratory, and Argonne National Laboratory).

FY 1987 objectives and associated budget levels are: (1) Performing independent analyses of DOE R&D programs to evaluate technical merit and future directions. One full program, depending upon the number of projects involved, can be analyzed within the Departmental Request ($400,000); (2) Performing independent assessments of technologies that may be contained within more than one program. Two or three technology assessments can be provided for within the Departmental Request ($500,000); (3) Support for Departmental research and coordination elements within the National Acid Precipitation Assessment Program (NAPAP), including $500,000 to support the Acid Deposition Assessment Staff and $150,000 to fund DOE's share of the Program Coordination Office support, and assessments leading to the 1987 NAPAP National Assessment ($700,000) for a total of $1,350,000; (4) Support of the assessments and advice provided by groups such as the Energy Research Advisory Board and JASON, to the Secretary, DOE ($1,000,000); and (5) Accomplishments assessments of R&D programs within Energy Research ($300,000).

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
UNIVERSITY RESEARCH SUPPORT
ENERGY SUPPLY RESEARCH AND DEVELOPMENT

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
University Research Support (ER) Operating Expenses:					
University Laboratory Research					
University Laboratory Cooperative Research...	$ 6,500	$ 5,773	$ 5,773	$ 7,775	$+ 2,002
University Reactor Fuel Assistance............	2,848	3,753	3,753	1,900	- 1,853
Subtotal......	$ 9,348	$ 9,526	$ 9,526	$ 9,675	$+ 149
Energy Manpower Development					
Energy Manpower Assessment.............	450	385	385	500	+ 115
Energy Education and Training...............	300	385	385	800	+ 415
Subtotal......	$ 750	$ 770	$ 770	$ 1,300	+ 530
Total Operating Expenses......	$ 10,098	$ 10,296	$10,296	$10,975	$+ 679
University Research Support.............	$ 10,098[a][b]	$ 10,296[c]	$10,296	$10,975	$+ 679

Authorization: Section 209, P.L. 95-91, Section 31, Atomic Energy Act of 1954, Section 103 (103) P.L. 93-483.

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[a] FY 1985 total does not include $102,000 transferred to the SBIR program.

[b] Total reflects a reduction of $1,000,000 in FY 1985 for management initiatives savings.

[c] Total reduced by $404,000 in accordance with P.L. 99-177, the Balanced Budget and Emergency Deficit Act of 1985 (Gramm/Rudman/Hollings).

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer. (1)	General Reduction (2)	Management Initiatives (3)	Pay Cost Restoration (4)	FTE General Reduction (5)	Gramm-Rudman-Hollings (6)	ES&H Transfer/ Reprogramming (7)	Subtotal (8)	Comparability Adjustments (9)	Total (10)
University Research Support (ER)										
University Laboratory Cooperative Program Operating Expenses	6,800	-800				-227		5,773		5,773
University Reactor Fuel Assistance Operating Expenses	3,900					-147		3,753		3,753
Energy Manpower Development										
Energy Manpower Assessment Operating Expenses	450	-50				-15		385		385
Energy Education and Training Operating Expenses	550	-150				-15		385		385
Subtotal, University Research Support	11,700	-1,000				-404		10,296		10,296
General Reduction	-1,000	1,000								
Management Initiatives										
Pay Restoration										
Use of Prior Year Balances (URS)										
Use of Prior Year Balances (Other Energy Supply)										
Total, University Research Support	$ 10,700	$ --				$ -404		$ 10,296		$ 10,296

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
UNIVERSITY RESEARCH SUPPORT
(In thousands of dollars)

1986 Appropriation enacted	$ 10,700
1986 Gramm-Rudman reduction	- 404
1986 adjusted	$ 10,296
Program increases and decreases:	
o Increases the number of faculty and student research appointments at the DOE laboratories by 20% and increases support for laboratory/HBCU cooperative projects	+ 1,302
o Provides for Laboratory Technology Exchange including research support for visiting industrial scientist appointments	+ 700
o Provides for base reactor fuel program	- 1,853
o Increases support for high school science teacher/student research projects at DOE laboratories	+ 530
1987 Budget Request	$ 10,975

The principal goal of the University Research Support (URS) program is to help maintain strong scientific/technical research capabilities in support of the Department's long range energy R&D mission. This is accomplished through supporting specialized research and manpower development efforts which complement and underpin the R&D mission of other Departmental programs. The URS program provides a special Departmental focus for several efforts which primarily involve universities both directly or in conjunction with the Department's national laboratories and major contractors. The URS supported activities may be distinguished from other Departmental university R&D programs by their multidisciplinary nature and by their focus on manpower development needs. Individual efforts carried out through the URS program relate to one or more of the following mission objectives:

- o Maintain and strengthen university-based energy research and manpower development efforts in selected high priority energy research fields.
- o Utilize the unique resources of the national laboratories (equipment, instrumentation, and personnel) for university faculty and student research and training.
- o Assist in the transfer of laboratory-developed technology and expertise to the private sector.
- o Increase the number and enhance the quality of students, including women and minorities, pursuing professional-level degrees in energy-related science or engineering.
- o Help strengthen the scientific/technical workforce in the Department's national laboratories.

There are two major subprograms within URS. The first subprogram, University Laboratory Research, is directed at strengthening the capabilities of both universities and national laboratories as major energy research performers in the conduct of long range energy research. Many of the specific activities supported within this subprogram rely on the use of facilities at the DOE Laboratories for faculty and student research training. This subprogram also includes support for implementing the Department's statutory responsibility for assessing the supply and demand of manpower for both current and projected energy R&D programs.

In order to carry out URS program objectives, a variety of approaches are used including faculty, graduate and undergraduate student research participation in national laboratory programs, joint efforts involving laboratory university scientists, and support for the operation of unique university-based nuclear research and training reactors.

In FY 1986, the following major accomplishments are planned for the URS program.

- o Support 2,000 faculty and student research and training appointments at the DOE laboratories. Support five to eight visiting industrial scientist research appointments at the DOE laboratories.
- o Refuel five to six university nuclear research reactors and support 20 university reactor sharing projects.
- o Continue in-depth analyses of the supply/demand for manpower in energy R&D programs including publication of a comprehensive survey of manpower requirements in a number of energy R&D areas of direct relevance to the Department.

- Support one to two high school teacher/student workshops in energy-related science and mathematics at the DOE laboratories and 21 Pre-freshman Engineering Program projects reaching over 2,000 secondary school students.

The URS program also supports special research contracts in which costs are shared by the universities. The universities' contributions are provided by a number of mechanisms, e.g., salaries to investigators, summer student assignments, provision of facilities and/or equipment, etc. The URS program encourages such cost sharing policies to achieve maximum utilization of available Federal funds.

	FY 1985	FY 1986	FY 1987 Request
University Research Support.............	$10,098	$10,296	10,975

The FY 1987 request for the University Research Support Program is $10,975,000. Specific priorities at the requested level are as follows:

- Support 2,500 faculty/student research training appointments at the laboratories (including 1,250 undergraduates).
- Initiate new Laboratory Technology Exchange Program including continuing cost-shared support for up to 25 visiting industrial scientists at DOE laboratories.
- Refuel seven university research reactors and support twenty reactor sharing grants.
- Support four laboratory-based high school science teacher/student workshops.
- Support 2,300 junior high school minority and women participants in the Pre-freshman Engineering Program.

The following sections describe the proposed activities which will be carried out at the FY 1987 request level within each of the major URS subprograms.

University Laboratory Research..........	$ 9,328	$ 9,526	$ 9,675

There are two major emphases in this subprogram. The first is strengthening the capabilities of universities and the national laboratories to conduct long range energy related research and to help ensure an adequate scientific and engineering manpower base for both current and future energy R&D programs. The second emphasis is enhancing and expanding the transfer of laboratory-generated research and technology to the private sector.

	FY 1985	FY 1986	FY 1987 Request
University Laboratory Cooperative Research............................	($ 6,474)	($ 5,773)	($ 7,775)

This activity includes a variety of approaches designed to bring the DOE laboratories, universities and industry into a closer partnership in meeting national priorities for energy research and manpower development. One of the principal objectives is to maintain the flow of manpower for future energy research programs by involving students in ongoing laboratory research programs. Additional research capabilities are also available to the Department's Laboratories through participating faculty. Funding is provided to ten multiprogram laboratories and university consortia (who work with other DOE contractors) for the placement of faculty, graduate, and undergraduate students in summer or academic year research activities.

The FY 1987 request includes support for the following:

- Undergraduate Student Research: Approximately 1,250 undergraduate science and engineering students will be supported in summer research assignments in the participating laboratories. Each student is assigned to an ongoing laboratory research program and is involved in energy related research significant to the Department's needs.

- Graduate Student Research: Graduate students who have completed their academic course work and are ready to undertake their thesis research are eligible for support under this program. About 250 graduate students in the sciences and engineering will collaborate with laboratory staff in areas of fundamental and applied research that are of interest to DOE.

- Faculty Research: About 300 faculty members from colleges and universities will participate in ongoing research at DOE laboratory and contractor sites. These appointments include both summer and academic year assignments. In a number of cases continued support is provided for on-campus research through funding provided directly by the laboratory's research programs and continued liaison with laboratory research staff.

- Special Energy R&D Training: Over 700 university faculty and students will participate in special energy-related workshops, short courses and institutes conducted at national laboratories on selected energy R&D topics and problem areas at the forefront of energy research. A sample of the workshops and institutes conducted within this activity are: Computer-Aided Spectroscopy, X-Ray Optics, Separation of Proteins by Two-Dimensional Electrophoresis, Measurement Techniques for Radium and Actinides, Overview of Advanced Energy Conversion Systems, etc. These workshops are important means by which state-of-the-art information on research and technology topics is disseminated to the university community.

- National Laboratory/Historically Black Colleges and Universities Programs: Continued support will be provided for cooperative research and manpower development programs between DOE laboratories and Black Colleges including ongoing efforts with Jackson State University/Lawrence Berkeley Laboratory and Atlanta University/Argonne National Laboratory.

- Laboratory Technology Exchange:

  As part of the Department's effort to expand the collaboration in research between the national laboratories and private industry, continued research support will be provided for visiting research appointments at DOE laboratories for industrial scientists. (This effort was budgeted in FY 1986 as part of the University-Laboratory Cooperative activity.) Participating laboratories identify research areas of potential interest to industries not already significantly involved in laboratory programs. Formal agreements are then developed with interested industries to bring industrial scientists to the laboratories for one year visiting research appointments. Up to 25 visiting appointments will be made in FY 1987 within the requested budget level. Cost sharing with industry will be involved in these appointments. Funds are also included in the FY 1987 request to support model methods and approaches for enhancing the transfer of laboratory based technology to U.S. industries. These approaches will identify and evaluate laboratory technologies with potential spinoff industrial applications. This effort will take fuller advantage of the scientific and technological capabilities at the DOE Laboratories with the purpose of helping to enhance the Nation's industrial competitiveness.

	FY 1985	FY 1986	FY 1987 Request
University Reactor Fuel Assistance......	($ 2,854)	($ 3,753)	($ 1,900)

This program provides fuel for university research and training reactors, particularly those higher powered reactors using Material Test Reactor (MTR) type fuel. The university-based nuclear research and manpower development effort is highly dependent on these specialized facilities not only for nuclear related training but also for research in the basic sciences. Some of the current uses are neutron physics research, trace analysis and radiochemistry, primarily in the fields of human nutrition, health and geochemistry, and research in materials such as structural alloys for fusion reactors, etc. Under the Reactor Sharing Activity, funding is provided to help defray reactor operational costs when the facility is "shared" with researchers from neighboring universities.

At the FY 1987 request level, seven reactors will be provided fuel and approximately twenty reactor sharing grants will be made on a competitive basis. Continued support will also be provided to ship and store excess reactor fuel at DOE Laboratory sites and other efforts responsive to university requests related to NRC requirements.

	FY 1985	FY 1986	FY 1987 Request
Energy Manpower Development.............	$ 770	$ 770	$ 1,300

This subprogram combines two manpower-oriented efforts--the Manpower Assessment effort which conducts studies and analyses of the supply and demand of manpower for both current and future energy R&D programs; and the Energy Education and Training effort which supports activities directed at encouraging secondary school students to pursue energy-related science and engineering programs at the college level.

Energy Manpower Assessment.............	(450)	(385)	(500)

The FY 1987 request of $500,000 for the Manpower Assessment activity will provide support for an in-depth analysis of the employment and utilization of engineering, scientific and related personnel over a 5 year period resulting from changing trends in public and private energy R&D funding and energy production and conservation activities. This effort will require the continued collection and analysis of base line data on the employment, utilization and supply of engineers and scientists in all types of energy-related activities and programs. Major components of this effort include a new survey of doctoral scientists and engineers involved in energy R&D and related activities and an analysis of the involvement of recent BS/MS science and engineering graduates in developing new energy technologies.

Energy Education and Training..........	(320)	(385)	(800)

This program activity supports the Department's longer term R&D mission by encouraging students to pursue energy-related scientific and technical careers. There are four interrelated efforts in this activity: the Pre-Freshman Engineering Program (PREP); the DOE Special Awards Program; high school science teacher institutes; and a high school science student research competition. The Pre-Freshman Engineering Program provides initial training in and exposure to careers in engineering for minority and women high school students through summer institutes at colleges and universities throughout the country. At the FY 1987 request, 20 PREP projects will be conducted reaching an estimated 2,300 students. This is a competitive grant program open to university engineering schools. The DOE Special Awards Program recognizes excellence in student energy research at the annual International Science and Engineering Fair. Each year, ten high school science students, along with their science teachers, receive week-long visits to one of the Department's national laboratories. Also, three laboratories will host high school science teacher workshops during FY 1987 aimed at better preparing classroom teachers in chemistry, physics, computer science and mathematics. Additionally, a high school student research competition program will provide an opportunity for 50-100 highly qualified high school science students to collaborate on energy research projects at selected DOE laboratories during the summer.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
UNIVERSITY RESEARCH INSTRUMENTATION
ENERGY SUPPLY RESEARCH AND DEVELOPMENT

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
University Research Instrumentation (ER) Operating Expenses.........	$4,950	$6,254	$6,254	$5,000	$-1,254
Total Operating Expenses.........	4,950	6,254	$6,254	5,000	-1,254
University Research Instrumentation.........	$4,950[a]	$6,254[b]	$6,254	$5,000	$-1,254

[a] FY 1985 total does not include $50,000 transferred to the SBIR program.

[b] Total reduced by $246,000 in accordance with P.L. 99-177, the Balanced Budget and Emergency Deficit Control Act of 1985 (Gramm/Rudman/Hollings).

Authorization: Section 209, P.L. 95-91

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
UNIVERSITY RESEARCH INSTRUMENTATION

(In thousands of dollars)

1986 Appropriation enacted..	$ 6,500
1986 Gramm-Rudman reduction..	- 246
1986 adjusted..	$ 6,254
Program increases and decreases:	
o Decreases the number of planned instrumentation awards by approximately 6 to 9..	-1,254
1987 budget request..	$ 5,000

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer.	Gramm-Rudman-Hollings	Subtotal	Comparability Adjustments	Adjusted Approp. Total
University Research Instrumentation (ER)					
Operating Expenses	6,500	-246	6,254		6,254
Subtotal, University Research Instrumentation	6,500	-246	6,254		6,254
Total, University Research Instrumentation	6,500	-246	6,254		6,254

The University Research Instrumentation Program provides support to university research groups on a competitive basis for the purchase of major, state-of-the-art scientific research instrumentation which is essential for continued progress in advanced energy-related scientific and technical research. Continued progress by university researchers in both fundamental energy sciences as well as research directed at improving current and developing new energy technologies requires direct access to new research instrumentation. For example, in the field of materials science, significant effort is being placed on the microanalysis of the structure and chemistry of matter. It is now possible to compare and study the microchemistry and microcrystallography of small samples of metals and ceramic materials. This research requires the use of a new generation of analytical, high resolution high voltage electron miscroscopes. Research advances in this area are directly relevant to long range research needs in fusion, advanced coal conversion, and solar photovoltaics. In the field of biological energy research a major limitation is in understanding the key proteins which influence physiological and genetic factors related to plant productivity. It is particularly difficult to determine the amino acid sequences of polypeptides. However, advances in the analytical capacity of mass spectrometry now offer biological scientists a means to overcome this problem.

Many university scientists do not have direct access to sophisticated, state-of-the-art scientific research instrumentation. This not only hampers their research but also significantly affects the training and preparation of graduate students for future research careers in industry, the university community or government laboratories. This is a serious national problem being addressed through the combined efforts of Federal science agencies, state governments, private industry and by the university community itself. The Federal effort is coordinated by the Office of Science and Technology Policy through the Interagency Committee on University Research Instrumentation. Each participating Federal agency is responsible for supporting university research instrumentation in relation to agency missions and programmatic needs.

The Department's response to this overall national effort is the University Research Instrumentation Program. The program was initiated in FY 1984 to help support the purchase, on a competitive and cost-shared basis, by university researchers of state-of-the-art instrumentation over $100,000 in purchase price.

In FY 1984, 17 competitive awards were made for instruments to support energy-related research in the following research areas: biological energy conversion, nuclear waste isolation, combustion, and multiphase and fluid flow phenomena. In FY 1985, 23 awards were made for instrumentation in the following fields: catalysis, advanced materials characterization, biological energy conversion, geosciences and CO_2 research, and health/environmental impacts of energy-related chemicals. In FY 1986 it is anticipated that 20 to 25 instrumentation awards will be granted. Examples of awards made to universities in both the FY 1984 and FY 1985 University Research Instrumentation program included such instruments as: a scanning Auger microprobe, a tunable dye laser system and several spectrometers (NMR, Ellipsometric, Thermal Ionization Mass, etc.)

	FY 1985	FY 1986	FY 1987 Request
University Research Instrumentation.......	$ 4,950	$ 6,254	$ 5,000

The FY 1987 request for the University Research Instrumentation Program is $5,000,000. This level will support an estimated 15 to 18 competitively selected awards for instrumentation costing over $100,000. As in prior years, the program will concentrate on providing instrumentation support to university research groups which have already demonstrated significant expertise in one of a small number of high priority energy-related topics which are of special concern to the Department's research programs. Among the topics to be considered in FY 1987 are: catalysis, materials characterization and analyses, the geological sciences and health effects research. Specific topics will be selected following discussions with both DOE program staff and university scientists.

The University Research Instrumentation Program remains complementary to but does not replace the Department's efforts to provide support for scientific equipment required on individual research projects supported through the various research programs.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
ADVISORY AND OVERSIGHT - PROGRAM DIRECTION
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
SUPPORTING RESEARCH AND TECHNICAL ANALYSIS

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
Energy Oversight, Research Analysis and University Support					
Advisory and Oversight Program Direction					
Operating Expenses....	$2,900	$2,674	$2,674	$2,900	$+ 226
Total....................	$2,900a/	$2,674a/b/	2,674	2,900a/	+ 226
Staffing Total FTE's.....	44	44	44	44	

a/ Totals reflect a reduction of $15,000 in FY 1985, $30,000 in FY 1986 and $55,000 in FY 1987 for management initiative savings.

b/ Total reduced by $106,000 in accordance with P.L. 99-177, the Balanced Budget and Emergency Deficit Control Act of 1985 (Gramm/Rudman/Hollings).

Authorization: Section 209, P.L. 95-91.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
ADVISORY AND OVERSIGHT PROGRAM DIRECTION

(In thousands of dollars)

1986 Appropriation enacted..	$ 2,780
1986 Gramm-Rudman reduction..	- 106
1986 adjusted..	2,674
Program increases and decreases:	
o Funding required to maintain FTE level..............................	+ 226
1987 budget request..	$ 2,900

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer. (1)	General Reduction (2)	Management Initiatives (3)	Pay Cost Restoration (4)	FTE General Reduction (5)	Gramm-Rudman-Hollings (6)	ES&H Transfer/ Reprogramming (7)	Subtotal (8)	Comparability Adjustments (9)	Total (10)
Advisory and Oversight Program Direction										
Operating Expenses	2,900	-87			-33	-106		2,674		2,674
Subtotal, Advisory and Oversight Program Direciton..	2,900	-87			-33	-106		2,674		2,674
General Reduction	-87	87								
Management Initiatives										
Pay Restoration										
Use of Prior Year Balances (AOPD)										
Use of Prior Year Balances (Other Energy Supply)										
Total, Advisory and Oversight Program Direction..	2,813	—			-33	-106		2,674		2,674

Advisory and Oversight Program Direction

The FY 1987 request for Advisory and Oversight Program Direction is $2,900,000. These funds are required to provide for the personnel and other costs associated with continuation of 44 full-time equivalents. These funds support the staff in the Office of Field Operations Management, the Office of Program Analysis, the Science and Technology Affairs Staff, and associated program and administrative support staff.

This program provides the personnel resources required by the Director of Energy Research to carry out his responsibilities under legislation (P.L. 95-91) and as mandated by the Secretary in areas beyond the scope of the other assigned Energy Research programs. This staff performs and supports in-house and external analyses and studies to meet ER's responsibilities for monitoring the Department's research and development programs and to advise the Secretary with respect to the well-being and management of the multiprogram laboratories. These responsibilities include advising on research activities carried out by any of the Assistant Secretaries; providing support for the Energy Research Advisory Board; operating the Department's multiprogram laboratory institutional planning process; supporting the Under Secretary in addressing laboratory management issues; and providing program management of the Energy Research Analysis, University Research Support, Multiprogram Energy Laboratories-Facilities Support (MEL-FS), R&D Laboratory Technology Transfer, and University Research Instrumentation programs.

The FY 1987 request supports the following staff activities:

1. The Office of Program Analysis will continue to support the Director, Office of Energy Research, in his role as the principal science advisor to the Secretary by providing technical assessments, independent peer reviews and program evaluations, and interagency coordination of research assessments. The Office will also continue to represent DOE on the Interagency Task Force on Acid Precipitation providing assistance as required by the National Acid Precipitation Assessment Plan.

2. The Office of Field Operations Management (FOM) will provide continued support to the Director, OER, in carrying out his oversight, assessment and program responsibilities relating to DOE-university relationships and support. Staff will continue to implement Secretarial guidelines on improved and expanded DOE-university relationships and enhanced information exchange between DOE and the university community. Additional staff workload has resulted from continuing increases in research and manpower development programs within the University Research Support (URS) program. Specifically, increased workload has resulted from expansion of support for the University Laboratory Cooperative (Lab Coop) program, which emphasizes the development of direct links between the DOE laboratories and the university community through support for faculty and student research appointments at the laboratories. Furthermore, the University Reactor Fuel Assistance program, which involves ensuring the maintenance of strong university-based capabilities in nuclear research and training through support for university nuclear research reactors, will require increased activity in FY 1986 in order to be responsive to NRC and congressional mandates on the conversion of university reactors to low enriched uranium (LEU) fuel.

3. FOM is responsible for the University Research Instrumentation program where staff effort is required in preparing an annual program solicitation, analyzing and reviewing proposals, selecting awards, and monitoring projects. The number of proposals received has increased from 150 to 210, and the number of awards has risen from 17 to 24. In addition, the staff is responsible for coordinating this

program with other Federal agencies participating in the overall interagency instrumentation support initiative.

4. Department-wide laboratory management activities of FOM will continue to increase. Specific workload includes provision of laboratory policy and management improvement recommendations and operation of the Department's institutional planning process, analytical support for the Under Secretary's and ER Director's reviews of issues relating to the laboratories, and interaction with the field to ensure implementation of a more effective laboratory appraisal process by the operations offices. Participation in internal working groups and external Government-wide groups will continue to place a significant demand on staff time. Recommendations from these working groups will require increased FOM attention and oversight of Work for Others programs at the laboratories and implementation of new patent legislation by the laboratories. The staff is responsible for ER institutional planning and overview of site plans and related facility issues at the five national multiprogram energy laboratories, as well as management of the MEL-FS construction program, which rehabilitates, upgrades, and replaces, as appropriate, support facilities at the national laboratories. The MEL-FS program has eight new starts proposed in FY 1987. In addition, the program is responsible for the ORNL environmental upgrade program and significant interaction and coordination with the new ES&H assessment program. The staff also manages the Department's R&D Laboratory Technology Transfer program and oversees the new Technology Exchange Research program (under Lab Coop) to provide industry scientists with visiting appointments at the laboratories to strengthen the Nation's industrial competitiveness. There is an increasing staff workload due to significantly increased technology transfer activities at the laboratories.

5. The Science and Technology Affairs Staff will continue to support the Energy Research Advisory Board whose average number of panels doubled in FY 1985 requiring substantial increases in support services; this workload will continue. In addition, three new Departmental awards, similar to the Lawrence and Fermi Awards, have been approved in the areas of conservation, fossil energy and renewable energy. A panel will be established for each of these new awards and the Science and Technology Affairs Staff will provide administrative support to the panels and will coordinate the entire awards process.

6. Program and management support in the areas of budget and finance, personnel administration, policy and coordination, and construction, environment and safety support will continue to be required.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
MAJOR ACTIVITY OVERVIEW

Multiprogram Energy Laboratories - Facilities Support Program

The goal of the Multiprogram Energy Laboratories - Facilities Support (MEL-FS) Program is to provide for the rehabilitation, upgrade, and replacement of multiprogram general purpose facilities at the five multiprogram energy laboratories: Argonne National Laboratory (ANL), Brookhaven National Laboratory (BNL), Lawrence Berkeley Laboratory (LBL), Oak Ridge National Laboratory (ORNL), and Pacific Northwest Laboratory (PNL). These Government-owned sites are complete research reservations with unique research facilities and all necessary support facilities. These include laboratory and office space, craft shops, warehouses, security facilities, fire houses, cafeterias, and all required utility distribution systems plus steam generation plants, sewage and other waste treatment facilities, roads, parking lots, and related structure and facilities, etc. These laboratories have performed national research programs for the Department and its predecessor agencies for nearly 40 years. They received over $1,000,000,000 in FY 1985 to perform national research programs primarily in the areas of energy supply and general sciences (i.e., nuclear energy, fusion energy, basic energy sciences, nuclear physics, high energy physics, life sciences, and other energy-related areas). Over 17,000 scientists, engineers and other support staff are engaged in these activities. The productivity of the work force is greatly affected by the adequacy and reliability of the facilities at the national laboratories.

The replacement costs of the existing facilities at the multiprogram energy laboratories exceed $2,800,000,000. Through continuous use, aging as well as changing technology, these facilities and related support systems deteriorate (both physically and in performance) to a point where they are no longer appropriate for their intended functions, economically justifiable to maintain, or adequate to meet security, environmental, safety, and health requirements. The MEL-FS program is responsible for maintaining existing capabilities and capacities consistent with approved utilization levels. This program will help ensure that the capital base is preserved for continued effective accomplishment of the Department's R&D missions today and in the future. The MEL-FS program is an appropriate Federal role reflecting the responsible management of the Government's real property.

This program consists of two subprograms. The first subprogram, Multiprogram Energy Laboratories - General Purpose Facilities (MEL-GPF), is directed at the goals of the overall program except for Environmental Compliance Upgrade at ORNL which is a separate subprogram. Each subprogram is discussed in detail below.

Multiprogram Energy Laboratories - General Purpose Facilities

The MEL-GPF program originated in FY 1981 as a broad program for rehabilitation, upgrade or replacement of deficient buildings, utilities, roads, railroads and other facilities at all the multiprogram laboratories. From FY 1981 to FY 1986, a total of $188,000,000 has been used for these purposes. Over one third of these funds went to defense multiprogram laboratories (Idaho National Engineering Laboratory, Sandia National Laboratories, Los Alamos National Laboratory, and Lawrence Livermore National Laboratory). Beginning with the FY 1987 budget, the program will be limited to only the Multiprogram Energy Laboratories with Defense Programs assuming responsibility for general purpose facilities projects at the defense multiprogram laboratories.

There exists a large backlog of deficiencies at the Multiprogram Energy Laboratories (recently estimated at over $700,000,000). The purpose of the program is to reduce this backlog in a prioritized and systematic manner. Highest priority is assigned to those projects that address urgent environmental, safety, health and security deficiencies and those that can significantly hamper or interrupt operations. The latter is primarily concerned with utilities - electrical, heating and cooling, compressed air, etc. Next highest priority are those projects that concern efficiency and productivity of operations, including adequate office and laboratory space, warehouse and shop facilities. Facility upgrade plans and all proposed projects and subprojects are consistent with the Institutional plans and Site Development plans for these laboratories.

Environmental Compliance Upgrade at ORNL

Over the years, ORNL has generated a variety of radioactive and nonradioactive wastes and has handled them consistent with the applicable Departmental polices. However, under environmental laws and regulations passed in recent years including the Resource Conservation and Recovery Act (RCRA), the Safe Drinking Water Act, the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the Hazardous Materials Transportation Act, long established procedures and approaches to handling hazardous wastes are no longer acceptable. In addition, the new regulatory requirements have resulted in the application of more stringent environmental criteria to ORNL operations. Consequently, ORNL is in violation of a number of these laws. The violations were verified in part during a recent Evaluation Inspection of ORNL conducted by the State of Tennessee and the Environmental Protection Agency. The Department is continuing to work with these agencies to determine the actions and time schedule necessary to come into compliance. The actions fall into two major categories: those that relate to the modification, replacement or upgrade of existing processes for handling wastes and those that relate to the cleanup of inactive contaminated facilities and sites. While the Department is addressing both areas, correction of ongoing waste processing systems has the highest priority.

The ORNL Environmental Compliance Upgrade Subprogram originated in FY 1985 to address those deficiencies that relate to non-defense activities at ORNL. Defense Waste Management has responsibility for defense related processes and wastes. A multiyear effort will be needed to bring ORNL's active and inactive systems into compliance with existing applicable environmental regulations.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
MULTIPROGRAM ENERGY LABORATORIES - FACILITIES SUPPORT
ENERGY SUPPLY RESEARCH AND DEVELOPMENT

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
Multiprogram Energy Laboratories-General Purpose Facilities Construction............	$ 33,200	$ 22,819	$ 22,819	$ 34,935	$+12,116
Subtotal MEL-GPF.......	33,200	22,819	22,819	34,935	+12,116
Environmental Compliance (ORNL)					
Operating Expenses.......	0 [a]	9,307	9,307	14,255	+ 4,948
Capital Equipment........	0	962	962	1,000	+ 38
Construction............	0	6,736	6,736	10,000	+ 3,264
Subtotal Environmental Compliance..........	0 [a]	17,005	17,005	25,255	+ 8,250
Total					
Operating Expenses.......	0	9,307	9,307	14,255	+ 4,948
Capital Equipment........	0	962	962	1,000	+ 38
Construction............	33,200	29,555	29,555	44,935	+15,380
Multiprogram Energy Laboratories - Facilities Support..................	$ 33,200	$ 39,824 [b] [c]	$ 39,824 [b] [c]	$ 60,190 [b]	$+20,366

Authorization: Section 647, Public Law 95-91.

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[a] Reprogramming request received final approval April 1985; $5,435,000 was devoted to this activity.

[b] Totals reflect a reduction of $310,000 in FY 1986, and $490,000 in FY 1987 for management initiatives savings.

[c] Total reduced by $1,591,000 in accordance with P.L. 99-177, the Balanced Budget and Emergency Deficit Control Act of 1985 (Gramm/Rudman/Hollings). Total reduced by $700,000 for proposed reprogramming to the Environmental Safety and Health (ES&H) Program.

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

Multiprogram Energy Laboratories Facilities Support	FY 1986 Confer.	Management Initiatives	Gramm-Rudman-Hollings	ES&H Transfer/ Reprogramming	Subtotal	Comparability Adjustments	Adjusted Approp. Total
Multiprogram General Purpose Facilities Construction	$ 24,025	$ -310	$ -896		$ 22,819		$ 22,819
Environmental Compliance							
Operating Expenses	10,400	--	-393	-700	9,307		9,307
Capital Equipment	1,000	--	-38	--	962		962
Construction	7,000	--	-264	--	6,736		6,736
Subtotal	18,400	--	-695	-700	17,005		17,005
Subtotal, Multiprogram Energy Laboratories Support	42,425	-310	-1,591	-700	39,824		39,824
Management Initiatives							
Operating Expenses	--	--					
Capital Equipment	--	--					
Construction	-310	310					
Subtotal	-310	310					
Total, Multiprogram Energy Laboratories Facilities Support	$ 42,115	--	$ -1,591	$ -700	$ 39,824		$ 39,824
Operating Expenses	(10,400)		(-393)	(-700)	(9,307)		(9,307)
Capital Equipment	(1,000)		(-38)	(--)	(962)		(962)
Construction	(30,715)		(-1,160)	(--)	(29,555)		(29,555)

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
MULTIPROGRAM ENERGY LABORATORIES - FACILITIES SUPPORT
(In thousands of dollars)

1986 Appropriation enacted	$41,415
1986 Gramm-Rudman reduction	- 1,591
1986 adjusted	39,824
Program increases and decreases:	
o Provides new construction starts at various locations for Multiprogram Energy Laboratories-General Purpose Facility (MEL-GPF) subprogram	+9,510
o Prior year projects	+2,606
o Environmental Compliance operating expenses to correct environmental problems at ORNL	+4,948
o Project at ORNL for Non-Radiological Process Waste Treatment Facility	+4,113
o Environmental compliance GPP/Capital Equipment	- 811
1987 budget request	$60,190

	FY 1985	FY 1986	FY 1987 Request
Multiprogram Energy Laboratories - Facilities Support......................................	$33,200	$39,824	$60,190

The MEL-FS program is responsible for assuring support facilities at the five energy multiprogram laboratories (ANL, BNL, LBL, ORNL, and PNL) are adequate for accomplishing the research missions assigned them in an efficient manner that meets security, environmental, safety, and health requirements. The General Purpose Facilities (GPF) subprogram and the Environmental Compliance Upgrade subprogram are discussed below.

	FY 1985	FY 1986	FY 1987 Request
Multiprogram Energy Laboratories - General Purpose Facilities..........................	33,200	22,819	34,935

As mentioned in the overview, the five multiprogram energy laboratories are complete research reservations with unique research facilities and all necessary support facilities to accommodate over 17,000 scientists, engineers and other support staff. The facilities include over 900 buildings (12,700,000 gross square feet of space) for laboratory and office space, craft shops, warehouses, security facilities, fire houses, cafeterias, vehicle and large equipment maintenance and repair, etc. Further, the laboratories have facilities to generate operating resources such as steam, chilled water, regular and special purpose waters, compressed air etc, and facilities to distribute these and electricity. There exist facilities to handle the many wastes streams (solid, liquid and air) that are generated in the normal course of research and development activities. And, there are roads, parking lots, street lighting, fencing and other site related facilities. The replacement costs of these facilities is over $2.8 billion in FY 1987 dollars.

In the late seventies the department focused attention on the declining overall condition of these facilities and increasing backlog of projects to renovate, upgrade and replace facilities. This led to the creation of this consolidated program (MEL-GPF) in FY 1981. The program systematically and comprehensively addresses the tasks of reducing the backlog and ensuring that facilities adequately meet research requirements as well as safety, health, environmental and security requirements.

The latest assessment of the backlog in FY 1985 indicated $700,000,000 in identified projects. All projects included had to address existing deficiencies only, could not significantly expand existing capacities or capabilities and had to have sound economic justification if space was to be added because of overcrowding, scattered operations or use of leased space. The bulk of these funds ($498 million) are for renovation, upgrade and replacement of existing buildings. Utility upgrades amounted to $184 million, and all other needs at $18 million. (The environmental upgrade needs at ORNL are not included in these estimates - see Environmental Compliance and Upgrade subprogram.)

Several factors contribute to the extensive backlog:

1. Inadequate Building Practices

   Much of the agency's original physical plant was built during times of crisis (e.g. World War II) when either shortages of materials or the urgency of the programs dictated utilizing inferior materials and/or rapid construction techniques. These practices have resulted in premature aging of some of the plant and expansion of routine maintenance to keep the plant on-line. More recently, as programs expanded, temporary facilities such as trailers and prefabricated buildings have been used in lieu of permanent facilities. These have a much shorter life span, and were contemplated to be temporary until more suitable facilities could be provided.

2. Aging and Deterioration

The aging and wear of facilities, particularly utility systems, affect the reliability of service and increase the downtime and routine maintenance costs for most systems. Real property at the laboratories averages 27 years, with many of the facilities going back to the 1940's and earlier. Many of these buildings and utility systems have no remaining service life and must be replaced to continue operations at the laboratories.

3. Facility Support Lagged Operating Growth

Improvements to support facilities did not keep up with increases in R&D programs. The result is that existing facilities have been utilized well beyond their design capacities. This is especially noticeable in utility systems, roads, and laboratory facilities. Because adequate permanent facilities have not been available, the laboratories have, of necessity, converted space designed for other purposes (e.g., warehouse space) into laboratory space, and have continued to rely on World War II barrack type buildings which are limited in application and have leased offsite space in several instances. Such solutions can seldom provide the quality laboratory space needed to meet today's research standards.

4. Lack of Institutional Support for GPF

Prior to the program, the installations suffered from a lack of adequate institutional support largely because they accommodate many programs. All resident programs fund operating expenses to cover the work performed. However, only the assigned lead program (i.e., landlord) had been responsible in the past for providing general purpose facilities, which actually support many or all residing programs. More often than not, budget ceilings have prevented the lead program from accommodating both direct program requirements and institutional needs including general purpose facilities.

The operational impacts of these facilities' deficiencies are: increased operating costs; increased safety, security, health and environmental risks; greater likelihood of program interruption and delay; and lower morale and productivity.

As part of the annual planning process for MEL-GPF, several steps have been taken to assure that most of the above practices are not repeated.

1. The Institutional Planning and Site Development planning processes are designed to ensure orderly planning of the operation, maintenance, and development of the multiprogram laboratories. These processes require careful consideration be given to facility needs, both strategic and specific.

2. A systematic, agency-wide approach to determining funding levels for General Plant Projects (GPP) has been established and a significant effort to increase overall GPP funding has begun.

3. An improved maintenance management system is being implemented to prevent the deferral of maintenance when it is detrimental to the physical well being of necessary facilities.

4. Better project development and management during construction will be utilized to keep the quality of construction high and costs low.

5. Finally, the planning and programming process utilized by the MEL-GPF program will assure that the proper attention is paid to potential critical deficiencies so that they may be corrected prior to any serious impact on mission accomplishment.

To address the most urgent needs, the Department is proposing a FY 1987 budget of $34,935,000. This funding level will just adequately maintain the capability and capacity of the laboratories to effectively support world class energy and general sciences research while meeting the Department's security, health, safety, environmental, and efficiency standards and goals. At this pace, the Department will adequately maintain its investment but the $700,000,000 backlog of deficiencies will not be reduced appreciably. The request for construction funds follow:

	FY 1985	FY 1986	FY 1987 Request
Construction	$33,200	$22,819	$34,935

The FY 1987 request of $34,935,000 for construction is required to continue ongoing projects, and to provide for needed new starts consistent with the plan to eliminate deficiencies developed over a 20 year period. This funding level is considered the essential "base" program. All project costs are supported by completed conceptual designs.

	TEC	FY 1987 Request
1. Continuation of Ongoing Projects		$25,425
Fire Protection Improvements, BNL (86-R-726)	3,000	2,500
Central Chilled Water Facility, BNL (85-R-701)	15,000	5,700
Replace Laboratory Roofs, ANL (85-R-702)	9,800	2,392
Electric Distribution System Upgrade, ORNL (85-R-703)	2,200	1,400
Medical Facility, LLNL (85-R-706)	7,300	4,000
Fire Alarm System, RL (85-R-707)	4,850	1,225
Central Chilled Water Plant, ANL (85-R-709)	5,200	3,600
Central Chilled Water System Restoration ORNL (85-R-712)	4,700	2,600
Road Repair (Various Locations) (84-ER-103)	19,190	2,008
2. New Starts		$ 9,510

The new projects proposed for FY 1987 are identified below. They have been selected based on a prioritization process that gives highest priority to subprojects that address significant environmental, safety, health and security deficiencies. Equally high in priority are subprojects that assure that ongoing research activities are not interrupted or delayed due to failures of support systems or services. These systems include production of steam and chilled water, utility distribution systems. Next highest priority subprojects are those that support the efficiency and productivity of operations, including major upgrading or renovation of buildings to provide adequate housing for the laboratory staff. Many of the subprojects below contain elements at all three priority levels (e.g., replacing an old leaking water system will ensure better fire protection and continued uninterrupted operations and will be less costly to maintain than existing systems). The total estimated cost for each project is based on a completed conceptual design report.

Type of Facilities	TEC	FY 1987 Request
Buildings:		
-Laboratory Restoration I, PNL (87-R-751)..	$ 2,100	$ 2,100
-Piping System Restoration, ORNL (87-R-752)	3,800	725
-Rehabilitate, Laboratory Space (87-R-753) (Building 200), ANL....................	12,035	1,235
Utilities:		
-Mechanical Systems Rehabilitation, ANL.... (87-R-755)	3,200	1,100
-Waterline Replacement, ANL (87-R-756).....	5,200	1,000
-Electrical System Rehabilitation, LBL..... (87-R-757)	2,600	300
-Rehabilitate Mechanical Utilities, LBL.... (87-R-758)	5,500	1,050
-Upgrade Steam Distribution System, ORNL... (87-R-759)	6,800	2,000
Total...........................		$ 9,510

The outyear mortgages for projects contained in the MEL-GPF subprogram are $23,399,000 in 1988, and $8,492,000 in 1989. Fuller descriptions and justifications for these projects are provided in the attached data sheets.

	FY 1985	FY 1986	FY 1987 Request
Environmental Compliance Upgrade (ORNL)............	$ 0*	$17,005	$25,255

As stated earlier in the major activity overview for the Multiprogram Energy Laboratories-Facilities Support Program, the Department is faced with an extensive environmental cleanup effort at ORNL. The environmental projects identified as necessary to be undertaken to ensure compliance with existing State and Federal regulations are significant. These projects range from identifying, monitoring, and cleaning up existing tanks, ponds, and burial grounds containing hazardous and radioactive wastes, to upgrading operating systems and processes for handling radioactive, hazardous, and chemical wastes.

In response to the need for comprehensive characterization of ORNL discharges to the environment, extensive groundwater monitoring and soil/sediment sampling programs were initiated. Characterization plans and site assessments are being proposed to outline multiyear remedial action efforts as required under the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Well installation was completed around the active surface impoundments in FY 1985, with work to continue through FY 1987 for the placement of an estimated 800 wells at the ORNL site. Near term characterizations are underway for the

*Reprogramming request received final approval April 1985; $5,435,000 was devoted to this activity.

priority sites, including the White Oak Creek Watershed, the RCRA impoundments, and specific Low Level Waste (LLW)-line leak sites. This characterization data will then be used to prepare long term closure plans for over 130 areas contained in the current inventory of contaminated ORNL sites.

In the area of modification, replacement, and upgrading of existing processes, progress has already been made and significant activities are planned. A new Sewage Treatment Plant has been constructed and is now operational. This plant has eliminated a significant National Pollutant Discharge Elimination System (NPDES) noncompliance problem. In addition, some 14,000 feet of sanitary line has been relined to reduce inflow of contaminated water and reduce the load on the plant. Activities are currently underway to characterize the process waste system for similar lining under FY 1986 GPP funding. A total of 22 RCRA compliance groundwater monitoring wells have been installed around active ORNL impoundments under FY 1985 GPP funding.

Upcoming activities will include the construction of a Nonradiological Wastewater Treatment Plant for removal of organics and heavy metals from ORNL process waste streams, continued upgrading of physical integrity of all ORNL waste collection systems, characterization activities for implementation of Best Management Practices as required by the NPDES permit, continued installation of RCRA compliance groundwater monitoring wells, elimination of sources of ORNL nitrate discharges, addition of process waste treatment capability at ORNL Y-12 facilities, installation of additional monitoring capability, and implementation of projects related to management of hazardous and mixed wastes and air pollution control.

It has been determined that $25,255,000 is required in FY 1987 to continue these efforts at ORNL. These funds consist of operating expenses, capital equipment, and construction as follows:

	FY 1985	FY 1986	FY 1987 Request
Operating Expenses........................	$ 0	$ 9,307	$14,255

The requested operating expense funds of $14,255,000 are required for the following:

- The process waste system is 40 years old and has reached design life expectancy. It has a number of identified problems including the integrity of the drainage system, connection of nonprocess-related drainage, and the lack of treatment available for chemical pollutants. To correct these problems, funds will be utilized to rehabilitate short sections of drainage lines, upgrade various manholes, correct connections of nonprocess wastewater into the system, and update piping drawings. In addition, design criteria, studies, and estimates will be prepared to support capital projects to upgrade the process waste system.

- The ORNL process waste system is in need of repair to prevent the inflow of contaminated groundwater into the system. Funds will be utilized to rehabilitate short sections of pipes, repair manholes, correct piping cross-connects, and update piping drawings.

- The ORNL storm sewer system needs to be upgraded to correct connections with the process waste system and to take corrective actions where the system has been contaminated by past spills of radioactivity and/or hazardous material. Funds will be used for minor corrective actions, to upgrade drawings, to eliminate cross-connects, and to repair and install dikes to isolate storage tanks from the storm sewer.

- o Eleven ponds at ORNL will require characterization, alternative assessment, and corrective actions to be in compliance with RCRA/CERCLA. Characterization of the ponds will be completed in FY 1987 and alternative corrective actions will be evaluated. Engineering designs for the final corrective actions will be initiated. In addition, some immediate corrective actions will likely be required to treat contaminated underground water. The extent of groundwater contamination will be determined in FY 1985 and FY 1986 as part of the characterization activities.

- o Some 32 past spill sites at ORNL will also require characterization, alternative assessments, and corrective action. Emphasis in FY 1987 will be on characterization and alternative evaluation at the priority sites (3019 and 3028 areas). These efforts will include installation of an extensive groundwater monitoring network, evaluation of the sampling data, and assessment of the alternatives for groundwater control in that area of the Laboratory.

- o The White Oak Creek watershed, which drains approximately 6.4 square miles, has received treated and untreated, radioactive and chemical effluent from ORNL activities since 1943. In FY 1987 a major effort to characterize the watershed and to evaluate remedial action alternatives will be made. This effort will result in thorough evaluation of alternatives so that the most cost effective cleanup can be implemented.

- o Long range planning and support to GPP projects will continue. In addition NEPA evaluations will be required for ponds, spill sites, and White Oak Creek water shed. The maintenance, surveillance, and decommission planning of selected inactive ORNL facilities will be initiated in FY 1987.

	FY 1985	FY 1986	FY 1987 Request
Capital Equipment.........................	$ 0	$ 962	$ 1,000

The requested capital equipment funds of $1,000,000 are required for general purpose equipment. This equipment will include sludge/soil handling equipment to support cleanup activities described above.

	FY 1985	FY 1986	FY 1987 Request
Construction..............................	0	6,736	10,000

The FY 1987 budget request of $10,000,000 for construction is required for general plant projects and one line item construction project.

	FY 1987 Request
1. General Plant Projects (87-R-770)..........................	$ 3,000

These projects provide for the many miscellaneous alterations, additions, modifications, and replacements of items required to reduce or eliminate environmentally harmful discharges from ORNL. The proposed projects in FY 1987 include replacing failed process and low level radioactive waste lines, installing process wastewater treatment systems, improving groundwater monitoring capabilities, and upgrading hazardous waste facilities.

	FY 1987 Request
2. Nonradiological Process Waste Treatment Facilities (86-R-801) TEC $18,000..................................	$ 7,000

The purpose of this project is to collect and treat the nonradiological waste effluents from ORNL facilities so that they will comply with the water quality requirements set by the State of Tennessee and the Environmental Protection Agency. The project includes pumps, tanks, and piping to transfer wastewater to a central treatment facility and the special equipment necessary to treat the wastewater to the limits established by the National Pollutant Discharge Elimination System (NPDES) permit for ORNL.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES
(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project: Road repair, various locations (ANL, INEL, LBL, RL)

2. Project No.: 84-ER-103

3. Date A-E work initiated: 2nd Qtr. FY 1984

3a. Date physical construction starts: 4th Qtr. FY 1984

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: $16,000
Date: August 1982

6. Current cost estimate: $19,190
Less amount of PE&D: 0
Net Cost Estimate: $19,190
Date: June 1984

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1984	$ 19,500[a/]	$ 6,500	$ 6,500	$ 737
1985	0	3,750	3,746	7,098
1986	0	2,973	2,973	3,028
1987	0	2,008	2,008	2,782
1988	0	2,717	2,717	1,917
1989	0	1,242	1,246	2,628
1990	0	0	0	1,000

8. Brief Physical Description of Project

This project is for the restoration, widening, and improvement of roads at various sites to improve traffic safety and bring these roads into conformance with current standards and practices in highway construction. Brief descriptions of each component, by site, follows:

A. Traffic Safety Improvements, Route 4, Richland, Washington - Approximately thirteen miles of Route 4, the arterial road servicing the Hanford area, will be improved to be more consistent with Washington State highway design

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[a/] $3,500,000 reprogrammed from 82-E-306 in FY 1984.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Road repair, various locations (ANL, INEL, LBL, RL)

2. Project No.: 84-ER-103

8. Brief Physical Description of Project (continued)

guidelines. Each lane will be widened approximately 2 feet to provide standard 12-foot lanes. Shoulder surfaces will be treated and widened to provide the standard design width. Acceleration, deceleration, and holding lanes will be provided where required.

Safety hazards such as poles, fire hydrants, and telephone cable boxes will be removed or relocated as required. Appropriate traffic control devices, lane markers, guard rails, roadway signs, pavement markings, and crash protection will be provided as necessary. Connecting service and frontage raods will be upgraded concurrently. The road shall be resurfaced with an asphalt overlay to eliminate the cracked and uneven places and to match and blend with the additions proposed by this project. The intended useful life of this project is 25 years.

B. INEL Road Refurbishment, Idaho National Engineering Laboratory (INEL), Idaho - This project provides for restoring approximately 37 miles of INEL primary and secondary roads to a safe and reliable condition. The project design will provide an engineered road cross section meeting traffic density and load requirements. Since this is not a total reconstruction project, the repair methods will vary from applying an asphaltic leveling course on the existing surface to demolishing and reconstructing the total road cross section. The work method selected will depend on conditions along the route of each section to be restored. The completed roads will have painted traffic striping, proper crown, adequate surface-thickness, engineered base-course, compacted subgrade and side drainage.

C. Roadwork Project - Safety Program, Lawrence Berkeley Laboratory (LBL), Berkeley, California - This project provides for increasing the radius of curves at various intersections and widening of the main access road to the Laboratory. Vertical and horizontal curves will be removed and roads realigned to conform to the Department of Transportation Highway Design Standard. Included will be separation of pedestrian and vehicular traffic in some areas of the complex.

D. Repair Existing Roads, Argonne National Laboratory (ANL), Argonne, Illinois - This project will reconstruct approximately 10 miles of roadway serving the ANL-East Laboratory site. Included in this reconstruction effort are the main entrance routes to the site and those roads serving the principal permanent buildings and facilities. Roads serving buildings that are to be deactivated will not be reconstructed.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Road repair, various locations (ANL, INEL, LBL, RL)

2. Project No.: 84-ER-103

8. Brief Physical Description of Project (continued)

Work to be performed includes:

a. Repair of base course failures
b. Resurfacing with 2-1/2 inch bituminous concrete topping
c. Rework and repair of road shoulders
d. Raising existing manholes to match new road alterations
e. Restriping of traffic lanes and crosswalks
f. Replacement of deteriorated culvert pipes

9. Purpose, Justification of Need for, and Scope of Project

A. Traffic Safety Improvements, Route 4, Richland, Washington - Route 4 is the arterial servicing the Hanford Site. This roadway was built in 1943 prior to formalization of national policies on highway design. Lack of conformance to current highway design guidelines has created serious traffic hazards on the Hanford Site. In addition, Route 4 has deteriorated over the years. The road surface is cracked and uneven, lanes are narrow, and in most places the shoulders are soft, narrow and rutted. The existing lanes are only 10 feet wide, 2 feet narrower than required by current standards. The 10-foot lanes allow very little maneuvering room, and create heavy traffic loads along the road edge. This stress causes pavement edge break-up and hence further reduction of lane width, and deep ruts in the shoulders. These factors have caused increased maintenance and safety problems. This project proposes to improve that portion of Route 4 from the 1100 Area to the Wye Barricade, a distance of approximately 13 miles. This area carries the greatest amount of traffic and has the highest accident rate.

B. INEL Road Refurbishment, Idaho National Engineering Laboratory (INEL), Idaho - The roads proposed for reconstruction are the sole access to active INEL Facility areas. They have been maintained in continuous use since their original construction during the 1950's and 1960's. Maintenance efforts since that time have included patching, seal coating and surface overlays. Deterioration in the base course and subgrade has progressed to the point that these efforts provide only short term improvement. In addition, pavement edge-breakage has narrowed the road in some sections to less than the minimum required for safe two-lane operation. The current situation has resulted from combinations of the following circumstances:

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Road repair, various locations (ANL, INEL, LBL, RL)

2. Project No.: 84-ER-103

9. Purpose, Justification of Need for, and Scope of Project (continued)

- o Existing roads that were not designed for current traffic density and loads which have led to continuing surface and subsurface breakdown.
- o Extreme winter cold temperatures ranging to -40°F causing surface course brittleness and shrinkage leading to extensive cracking, subsequent moisture penetration and subsurface failure.
- o High summer temperatures ranging to 100°F causing road weakness in areas of minimum road stability. This results in ruts, depressions and washboards on the road surface.
- o Moisture entry through surface cracks and unpaved shoulders. This causes reduced subsurface support strength and surface breaking.
- o Frost heave caused by soil capillarity and poor drainage during winter weather. This results in both surface breakup and subsurface failure.

C. Road Project - Safety Program, Lawrence Berkeley (LBL), Berkeley, California - The existing radius of the curves of the main access road to the laboratory are such that semi-trailers are found to go over the road center line. In some areas of the laboratory pedestrians and vehicles must use the same road way.

Improvement of the laboratory roading and pedestrian systems is required to bring the old substandard roads and sidewalks in the hilly LBL terrain up to acceptable code and safety standards by improving alignment sight distance, removing horizontal and vertical curves, increasing the radius of curves and widening the access road to the site.

This project will be constructed at the Lawrence Berkeley Laboratory which is non-Government owned property.

D. Repair Existing Roads, Phase I, Argonne National Laboratory (ANL), Argonne, Illinois - The site roads are deteriorating at a faster rate than they can be economically repaired. This deterioration reflects the age of the roads, approximately 30 years, and the severity of the climate at the ANL-East site. Failing road edges, the result of base course failures and late winter thaws, cannot be corrected by patching methods. The use of operating funds in an attempt to maintain the roadways in serviceable condition has resulted in unsatisfactory road conditions at best, and a heavy drain on the Laboratory's resources.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Road repair, various locations (ANL, INEL, LBL, RL)

2. Project No.: 84-ER-103

9. Purpose, Justification of Need for, and Scope of Project (continued)

A full reconstruction program for those sections of the roadway network which are in worst condition will be provided by this project.

10. Details of Cost Estimate*

	Richland	INEL	LBL	ANL	Total
a. Engineering and design and inspection................	$ 900	$ 535	$ 165	$ 200	$ 1,800
b. Construction costs................................	5,100	5,800	2,745	1,600	15,245
Subtotal................................	6,000	6,335	2,910	1,800	17,045
c. Contingency..	800	955	190	200	2,145
Total estimated cost.........................	$ 6,800	$ 7,290	$ 3,100	$ 2,000	$19,190

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*Conceptual Design Reports completed.

11. Method of Performance

A. RL Subproject - Design and inspection will be accomplished by a negotiated architect-engineering contract or the on-site architect-engineer firm. The major portion of the construction will be accomplished under fixed-price contracts awarded on the basis of competitive bids. Relocation of any power or utility poles will be accomplished through negotiations with the appropriate utility.

B. INEL Subproject - Overall responsibilities for design and construction will be assigned to the INEL prime contractors administered by DOE-ID. The INEL contractor will provide technical direction of the design effort. Construction will be accomplished by fixed price subcontracts awarded on the basis of competitive bidding.

C. LBL Subproject - Design and inspection will be performed under a negotiated architect-engineer contract. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts and subcontract awarded on the basis of competitive bidding.

D. ANL Subproject - Engineering, design and inspection will be performed by Laboratory engineering personnel. Construction will be accomplished by fixed-price contract awarded on the basis of competitive bidding.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Road repair, various locations (ANL, INEL, LBL, RL) 2. Project No.: 84-ER-103

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	Total
a. Total project costs									
1. Total facility costs									
(a) Construction line item	$ 0	$ 737	$ 7,098	$ 3,028	$ 2,782	$ 1,917	$ 2,628	$ 1,000	$19,190
(b) PE&D	0	0	0	0	0	0	0	0	0
(c) Expense funded equipment	0	0	0	0	0	0	0	0	0
(d) Inventories	0	0	0	0	0	0	0	0	0
Total facility costs	$ 0	$ 737	$ 7,098	$ 3,028	$ 2,782	$ 1,917	$ 2,628	$ 1,000	$19,190
2. Other project costs									
(a) R&D necessary to complete construction	$ 30	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 30
(b) Other project related costs	0	0	0	0	0	0	0	0	0
Total other project funding	30	0	0	0	0	0	0	0	30
Total project costs (1 and 2)	$ 30	$ 737	$ 7,098	$ 3,028	$ 2,782	$ 1,917	$ 2,628	$ 1,000	$19,220

b. Other related annual costs (estimated life of project: 25 years)	Annual Cost
1. Facility operating costs	$ 50
2. Programmatic operating expenses directly related to the facility	0
3. Capital equipment not related to construction but related to the programmatic effort in the facility	0
4. GPP or other construction related to programmatic effort in the facility	0
Total other costs	$ 50

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Road repair, various locations (ANL, INEL, LBL, RL)   2. Project No.: 84-ER-103

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project costs:
  1. Total Facility:
    a) Construction Line Item
    b) PE&D - No PE&D required.
    c) Expense Funded Equipment - There is no expense funded equipment.
    d) Inventories - There are no inventories required.

  2. Other project funding:
    a) Research and Development is not necessary for this project. The amount shown covers conceptual design activities.
    b) Other Project Related Costs - No other project related costs are anticipated.

b. Total related funding requirements:
  1. These costs are the average maintenance cost of roads at the various sites. They are based on a cost per square foot of new surface escalated to 1987.
  2. Programmatic Operating Expenses - None
  3. Capital Equipment not Related to Construction - None
  4. GPP or Other Construction Related to Programmatic Effort - No GPP funds are required by this project.
  5. Other Costs - No other costs are anticipated.

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1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES
(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project: Central chilled water facility
Brookhaven National Laboratory
Upton, New York

2. Project No.: 85-R-701

3. Date A-E work initiated: 1st Qtr. FY 1985

3a. Date physical construction starts: 1st Qtr. FY 1986

4. Date construction ends: 3rd Qtr. FY 1988

5. Previous cost estimate: none
Date: none

6. Current cost estimate: $15,000
Less amount for PE&D: 0
Net cost estimate: $15,000
Date: September 1983

7. Financial Schedule:

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1985	$15,000	$ 2,200	$ 2,200	$ 425
1986	0	6,832	6,832	1,292
1987	0	5,700	5,700	6,895
1988	0	268	268	6,388

8. Brief Physical Description of Project

This project proposes the construction of a central chilled water and compressed air facility. It will provide 5,100 tons of refrigeration and 1,500 standard cubic feet per minute (SCFM) of compressed air service for distribution to the following six major research complexes on site: Biology - Building 463; Medical Research Center - Building 490; Physics - Building 510; Applied Mathematics - Building 515; Laboratory Wings - Building 703; Hot Laboratory - Building 801.

The project consists of the installation of approximately 16,000 feet of underground chilled water piping and 8,000 feet of compressed air piping; the erection of one 5,100 ton capacity multicell cooling tower of completely fireproof construction and two buildings (a central chilled water and compressed air structure, and a condenser water pump

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water facility
Brookhaven National Laboratory
Upton, New York

2. Project No.: 85-R-701

8. Brief Physical Description of Project (continued)

house) having a total gross area of approximately 6,140 square feet and a gross volume of 115,100 cubic feet. Necessary switchgear at 13.8 KV, 2.4 KV and 480 volts, and a 500 KVA transformer substation are also included. Certain utility systems that interfere with construction will be extended, modified, or relocated; these include steam, water, electric power, telephone, and storm and sanitary drains. The present macadam service road (Temple Place) located adjacent to the central steam plant will be extended (20' x 50') in order to provide access to the proposed facility.

The building identified as central chilled water and compressed air structure will be approximately 56' x 90' x 20' high. This building will abut and connect with the south wall elevation of the existing central steam facility.

The building will be approximately 5,040 square feet and will consist of slab-on-grade, steel framing, insulated sandwich wall siding with a built-up insulated roof deck.

The equipment level at grade will contain the following major refrigerations apparatus and associated components: Three 1,700 ton chillers, one 1,500 SCFM air compressor, three chilled water pumps, an automatic central control and monitoring system, electrical switchgear, motor control stations and associated piping and electrical lines.

The condenser water pump house of approximately 1,100 square feet will house two vertical condenser water pumps, and will be constructed with a slab-on-grade, concrete block walls, and built-up roof deck.

9. Purpose, Justification of Need for, and Scope of Project

This project is the most cost effective method for replacing major refrigeration and compressed air equipment that have become obsolete and beyond economical repair. The multiple independent systems that exist at Brookhaven National Laboratory historically have ever increasing operating and maintenance costs as the equipment ages. A new central chilled water facility would have lower maintenance and operating cost, and be able to maximize load diversity presently not possible with the independent building systems.

This project provides a firm base for substantial future reductions in capital construction, maintenance costs and energy consumption. In the future, work and spent individual air conditioning and compressed air systems in other scientific buildings will be replaced with chilled water and compressed air from the proposed central facility.

1. Title and location of project: Central chilled water facility
Brookhaven National Laboratory
Upton, New York

2. Project No.: 85-R-701

9. Purpose, Justification of Need for, and Scope of Project (continued)

Background Profile of Existing Systems and Facilities

The existing decentralized systems of air conditioning, refrigeration, and compressed air are the result of each system being conceived as a self-contained entity as opposed to other basic utility services such as electrical power, potable water, waste water, steam, gas, etc., which are extended to a new facility from a central source. Chilled water, however, presently requires refrigeration units (centrifugal, steam absorption, etc.), cooling towers, pumps, electrical equipment, etc. to provide complete and independent systems for supplying environmental air conditioning to each building. This approach has resulted in a multiplicity of equipment and systems.

The major buildings are presently served by 36 units consisting of steam absorption, centrifugal and helical screw, refrigeration water chillers totaling 11,147 tons.

There are approximately 6,500 tons of additional refrigeration installed throughout various complexes. These range from small one-ton window air conditioning units to 150-ton reciprocating refrigeration assemblies.

Proposed Central Chilled Water Facility

It is proposed to construct a central chilled water and compressed air facility as a utility similar to other central facilities. The new chilled water plant will supply the refrigeration requirements for the six buildings and eliminate the use of well water used for once-through cooling at the Medical Research Center. The cooling systems being replaced were installed in the 1950s and 1960s and are obsolete, and beyond their normal life expectancy, and incur increasing operational and maintenance costs each year. In addition, this proposed facility would supply a source of clean, oil-free, low dewpoint compressed air for experimental and utility services within these facilities.

The proposed central chilled water and compressed air facility offers many tangible benefits over the multiplicity of the decentralized systems. Some of the major benefits are:

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water facility
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Upton, New York

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9. Purpose, Justification of Need for, and Scope of Project (Continued)

A. Permit new refrigeration systems to be installed at a lower initial cost ($360/ton) as compared with separate, independent systems ($790/ton).

B. Reduce operating and maintenance costs due to the elimination of independent chilled water and compressed air systems by centralization of major equipment.

C. Reduce capital installation costs due to utilization of load diversity among the various complexes.

D. Provide two additional proven wells for integration with the laboratory's potable and firefighting water supply system. The two existing wells in the Medical Research Center used for once-through cooling can be diverted to reinforce the domestic water system capacity.

E. Provide for restructuring of the laboratory's present steam supply by removing from service the existing steam absorption machines (used for cooling). Approximately 148 million pounds of steam per year will be redeployed for better utilization (e.g., 20,000 lbs. of steam per hour for winter heating in lieu of winter air conditioning).

F. Permit the recycling of treated effluent from the central sewage facility for use as make-up at the central steam plant and the proposed central chilled water and compressed air plant. This would reduce the load on the potable water system by approximately 600 gpm.

G. Utilize the return tower condenser water to preheat boiler water make-up (approximately 25,000 GPD) at the Central Steam Facility conserving approximately 90 million pounds of steam a year (equal to saving 700,000 gallons of No. 6 fuel oil).

H. Reduce the energy costs at the six buildings by approximately 56% in today's dollars due to improved utilization and diversity source.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water facility
Brookhaven National Laboratory
Upton, New York

2. Project No.: 85-R-701

10. Details of Cost Estimate

		Item Cost	Total Cost
a. Architect-engineer, design and inspection at approximately 12% of construction costs, Item c			$ 1,400
b. Land and land rights			0
c. Construction costs			11,600
(1) Improvements to Land		$ 98	
Site preparation (L.S.)	$ 60		
Road and area surfacing, 1000 S.Y. @ $28	28		
Area lighting (L.S.)	10		
(2) Buildings (6,140 S.F. @ approximately $136)		833	
(3) Equipment (within buildings)		6,050	
1700-ton machine (3) @ $516,000	$ 1,548		
Primary chilled water pumps (3) @ $39,000	117		
Secondary chilled water pumps (6) $14,000	84		
Air compressor (1)	187		
Chilled water, condenser, water, compressed air piping and miscellaneous accessories and equipment including six building tie-ins	2,789		
Condenser water pumps (2) @ $52,000	104		
Chemical water treatment system	91		
Automatic central control and monitoring system	905		
Electrical switchgear and distribution	225		
(4) Cooling Tower		536	
(5) Utilities		4,083	
Relocation of piping, electric lines, sewer and storm piping telephone, switchgear and distribution	932		
Chilled and condenser water supply and return piping	2,208		
Compressed air piping, valves (approximately 30 @ $6500), excavation, backfill, etc. for all underground utilities (10,000 ft. @ $46 per ft.)	943		
Subtotal			$13,000
d. Contingency @ approximately 15% of above costs			2,000
Total estimated cost			$15,000

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water facility
Brookhaven National Laboratory
Upton, New York

2. Project No.: 85-R-701

11. Method of Performance

Design and inspection will be performed under a negotiated architect-engineer contract. Construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1985	FY 1986	FY 1987	FY 1988	Total
a. Total project costs						
1. Total facility costs						
(a) Construction line item ..	$ 0	$ 425	$ 1,292	$ 6,895	$ 6,388	$15,000
(b) PE&D	0	0	0	0	0	0
(d) Inventories	0	0	0	0	0	0
Total facility costs ..	0	$ 425	$ 1,292	$ 6,895	$ 6,388	$15,000
Total project costs	$ 0	$ 425	$ 1,292	$ 6,895	$ 6,388	$15,000

b. Other related annual costs (estimated life of project: 20 years)

1. Facility operating cost	$1,549
2. Programmatic operating expenses directly related to the facility	0
3. Capital equipment not related to construction but related to the programmatic effort of this facility	0
4. GPP or other construction related to the programmatic effort in the facility	0
5. Other costs	0
Total related annual costs	$ 1,549

The $1,549,000 annual operating cost is estimated as follows:

Maintenance and Operation	$ 317,000
Energy (Utilities)	1,232,000
Total operating costs	$1,549,000

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water facility
Brookhaven National Laboratory
Upton, New York

2. Project No.: 85-R-701

12. Funding Schedule of Project Funding and Other Related Funding Requirements (continued)

However, if this facility is not funded, the existing systems in the six (6) buildings previously mentioned will have an annual operating cost as follows:

Maintenance and Operation	$ 578,000
Energy (Utilities)	2,341,000
Total operating costs	$2,919,000

The annual savings of non-energy is $261,000 and energy is $1,109,000 for this proposed facility, when constructed.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding
  1. Total facility
    (a) Construction line item - Not required
    (b) CP&D - Not required
    (c) Expense funded equipment - Not required
    (d) Inventories - Not required

  2. Other project funding
    (a) R&D necessary to complete - Not required
    (b) Other project related funding - Not required

  3. Capital equipment not related to construction but related to the activity effort in the facility.
    Not required

  4. GPP or other construction related to programmatic effort
    Not required

  5. Other costs
    Not required

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MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Replace laboratory roofs
Argonne National Laboratory
Argonne, Illinois

2. Project No.: 85-R-702

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3. Date A-E work initiated: 1st Qtr. FY 1985

3a. Date physical construction starts: 4th Qtr. FY 1985

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: none
Date: none

6. Current cost estimate: $ 9,800
Less amount for PE&D: 0
Net cost estimate: $ 9,800
Date: December 1983

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7. Financial Schedule

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1985	$ 9,800	$ 3,308	$ 3,308	$ 2,110
1986	0	2,983	2,983	3,803
1987	0	2,392	2,392	2,770
1988	0	1,117	1,117	1,117

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8. Brief Physical Description of Project

The proposed project will replace built-up membrane roofs on principal general purpose laboratory buildings, giving priority to existing conditions. Approximately 880,000 sq. ft. of roof will be replaced. The work will consist of stripping existing membrane and insulaton where conditions require, patching decks as required, improving drainage by compensating for low spots, installing new current technology membranes designed to best fit field conditions, adding insulation to bring heat transfer resistance up to current DOE standards, and, finally, providing protection to the membranes from temperature extremes and attack from photochemical activity. Flashings, curbs, gravel stops, and fascia will be renewed as their conditions dictate. Satisfactory function of roofing components will be warranted for 10 years, directly by the material manufacturers.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Replace laboratory roofs
Argonne National Laboratory
Argonne, Illinois

2. Project No.: 85-R-702

9. Purpose, Justification of Need for, and Scope of Project

The purposes of this project are to restore the weather tightness of roofs on laboratory buildings, and to bring the resistance to heat transfer up to current Federal energy use standards. This project provides a multi-year plan, described in the ANL Institutional Plan, FY 1983-FY 1985, whose goal is the replacement of all roofs older than 25 years on permanent general purpose buildings. At this age they have exceeded normal life expectancy for conventional built-up membrane construction. Resources expended on reconditioning efforts exceed good business judgment, yet the research programs housed under the roofs have been impacted.

Total replacement is required. Programs housed in these buildings include Basic Energy Research, Fossil Energy Research, Conservation, Renewable Energy, Environmental Protection, Safety, and Emergency Preparedness. Twenty one buildings are scheduled with approximately 880,000 square feet of roof needing immediate attention.

10. Details of Cost Estimate

ANL has replaced over 70,000 square feet of roofs since 1982 under five separate competitively bid contracts. In addition to the roof area, the amount of roof and insulation to be removed, the relative number of roof penetrations and other complications to be provided all produced a range of unit prices from $6.03 to $8.68 per square foot when normalized to mid-1982. The mean unit cost derived from these bids was $7.30 in mid-1982.

The various elements contributing to the total unit cost of roof replacement are identified in the following table:

Job Cost Breakdown

Cost Element	$ Per Sq Ft Mid-1982
Tear-off of old roof and insulation (90% of roof area)	$1.34
Preparation of substrate	0.38
Improve water drainage (average)	1.04
Single-ply PVC membrane	1.48
Irma Board - 2" thick insulation	2.04
Pro-rated edge and penetration details (average)	1.02
Warranties (included in above costs)	--
Estimated total	$7.30

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Replace laboratory roofs
Argonne National Laboratory
Argonne, Illinois

2. Project No.: 85-R-702

10. Details of Cost Estimate (continued)

The following estimated total cost of the project is for the construction of approximately 200,000 square feet for three years, 80,000 square feet in the last year of the project. The above unit cost of $7.30 in mid-1982 has been escalated for each annual increment of construction, using the escalation rates projected below.*

	Total Cost
a. Engineering, design and inspection at approximately 11% of construction, Item b.	$ 900
b. Construction costs, 880,000 sq. ft. @ $10.80/sq. ft.	8,000
c. Contingency @ approximately 10% of above costs	900
Total estimated cost..	$ 9,800

*Based upon a completed conceptual design and current cost data.

11. Method of Performance

Engineering, design and inspection will be performed by laboratory engineering personnel. Construction will be accomplished by fixed-price contracts awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1985	FY 1986	FY 1987	FY 1988	Total
a. Total project costs						
1. Total facility costs						
(a) Construction line item ..	0	$ 2,110	$ 3,803	$ 2,770	$ 1,117	$ 9,800
(b) PE&D	0	0	0	0	0	0
(c) Expense funded equipment.	0	0	0	0	0	0
(d) Inventories	0	0	0	0	0	0
Total facility costs .	0	$ 2,110	$ 3,803	$ 2,770	$ 1,117	$ 9,800

1. Title and location of project: Replace laboratory roofs
Argonne National Laboratory
Argonne, Illinois

2. Project No.: 85-R-702

12. Funding Schedule of Project Funding and Other Related Funding Requirements (continued)

	Prior Years	FY 1985	FY 1986	FY 1987	FY 1988	Total
2. Other project costs						
(a) R&D necessary to complete construction	0	0	0	0	0	0
(b) Other project related costs	8	0	0	0	0	8
Total other project costs	$ 8	$ 0	$ 0	$ 0	$ 0	$ 8
Total project costs (Items 1 and 2)	$ 8	$ 2,110	$ 3,803	$ 2,770	$ 1,117	$ 9,808

b. Other related annual costs (estimated life of project: 20 years)

1. Facility operating costs	0
2. Programmatic operating expenses directly related to the facility	0
3. Capital equipment not related to construction but related to the programmatic effort in the facility	0
4. GPP or other construction related to programmatic effort in the facility	0
5. Other costs	0
Total other related annual costs	0

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding
  1. Total facility
    (a) Construction line item - No narrative required
    (b) PE&D - None
    (c) Expense funded equipment - None
    (d) Inventories - None

  2. Other project funding
    (a) No R&D effort is required
    (b) $8,000 spent for conceptual design

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Replace laboratory roofs
Argonne National Laboratory
Argonne, Illinois

2. Project No.: 85-R-702

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

b. Total related funding requirements - The roofing components to be replaced or rehabilitated will have useful lifetimes of approximately 20 years.

1. Facility operating costs - Implementation of this project will rehabilitate or replace physical components of buildings. This will result in a reduction of maintenance costs while restoring the respective system components to an acceptable level of operational efficiency, thus the facility operating cost is reported as zero.
2. Programmatic operating expenses directly related to the facility - Although this project will rehabilitate general purpose facilities employed to perform a wide variety of activities, there is no programmatic operating expense directly related to, or required for supply of this project, thus the programmatic operating expenses is reported at zero.
3. Capital equipment not related to construction but related to the programmatic effort in the facility - None
4. Maintenance, repair, GPP or other construction related to programmatic effort - None
5. Other costs - None

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ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES

(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project: Primary electrical distribution system restoration
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 85-R-703

3. Date A-E work initiated: 1st Qtr. FY 1985

3a. Date physical construction starts: 4th Qtr. FY 1985

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate:
Date: none

6. Current cost estimate: $ 2,200
Less amount for PE&D: 0
Net cost estimate: $ 2,200

Date: September 1983

7. Financial Schedule

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1985	$ 2,200	$ 800	$ 800	$ 229
1986	0	0	0	440
1987	0	1,400	1,400	671
1988	0	0	0	860

8. Brief Physical Description of Project

This project will involve a series of restoration activities which will increase the reliability of the existing electrical distribution system to an appropriate level. These activities will include repair or replacement of

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Primary electrical distribution system restoration
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 85-R-703

8. Brief Physical Description of Project (continued)

deteriorated components, replacement of deficient items, and the elimination of potential safety and environmental hazards. Deteriorated equipment to be replaced includes wooden poles, transformers, and cables. Correction of deficiencies include replacing fused disconnect switches with electrically-operated circuit breakers, improving lightning protection of overhead lines, and replacement of single-pole switches with three-pole switches. Correction of potential safety hazards includes additional isolation switches for buildings and facilities and improved relaying. Correction of potential environmental hazards includes replacing deteriorated liquid-filled (oil and polychlorinated biphenol [PCB]) transformers.

9. Purpose, Justification of Need for, and Scope of Project

This project will renew and upgrade the existing primary electrical distribution system to an appropriate level of reliability and enable it to effectively support various research activities at the Laboratory. Much of this system at Oak Ridge National Laboratory (ORNL) was built in 1943. Many of the components are beyond their expected life and are showing clear evidence of deterioration to the point where an escalating number of failures are projected. Examples of this deterioration are: (1) several oil filled transformers which have become severely corroded internally due to moisture and acid content will be replaced; (2) fused disconnect switches will be replaced with the electrically operated circuit breakers; (3) unshielded cable which is in violation to the National Electric Code will be replaced with approved shielded cable; (4) lightning protection will be improved on those circuits supplying the High Flux Isotope Reactor, Transuranium Processing Plant, Health Physics Research Reactor and to the Tower Shielding Facility thereby increasing the reliability of these circuits.

In addition, single pole switches will be replaced with three pole switches. This change will allow operating personnel to be better utilized during emergency conditions and reduce switching time which results from waiting for called in maintenance personnel.

The cost estimate is based on a conceptual design completed during FY 1982 and will be issued during FY 1983 at an estimated cost of $20,000.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Primary electrical distribution system restoration
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 85-R-703

10. Details of Cost Estimate*

	Item Cost	Total Cost
a. Engineering, design, and inspection at approximately 13% of construction costs, item b		$ 220
b. Construction costs		1,720
(1) Outside utilities	$, 1,720	
Subtotal		$ 1,940
c. Contingency at approximately 13% of above costs		260
Total estimated cost		$ 2,200

*Based on a Conceptual Design Report completed in FY 1982 at a cost of approximately $20,000.

11. Method of Performance

Design and inspection will be performed under a negotiated architect-engineer contract. Construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

Not Required. TEC is less than $5,000,000.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Not Required. TEC is less than $5,000,000.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
MUTLIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Medical facility
Lawrence Livermore National Laboratory
Livermore, California

2. Project No.: 85-R-706

3. Date A-E work initiated: 1st Qtr. FY 1985

3a. Date physical construction starts: 1st Qtr. FY 1986

4. Date construction ends: 1st Qtr. FY 1988

5. Previous cost estimate: None
Date: none

6. Current cost estimate: $ 7,300
Less amount for CP&D: 0
Net cost estimate: $ 7,300
Date: September 1983

7. Financial Schedule

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1985	$ 7,300	$ 500	$ 500	$ 196
1986	0	2,694	2,694	2,194
1987	0	4,000	4,000	4,804
1988	0	106	106	106

8. Brief Physical Description of Project

This project will provide a 25,600 gross square foot building for a new and expanded facility for Health Services and will house all of the 32 medical staff and support personnel. The functions accommodated in this space will be a waiting area, receptionist, interview rooms, administrative offices, records area, health maintenance offices, physical examination rooms, observation room, emergency treatment (major and minor), diagnostic laboratories, specimen rooms, X-ray room, dark room/process lab, autoclave and clean hold area, ambulance entry, personnel decontamination facility, eye safety examination rooms, toilets, storage and equipment rooms.

The building will be designed to relate to the existing nearby major facilities and will be constructed of fire-resistive materials. Fire sprinkler system as well as other safety devices, will be installed. Normal medical laboratory building utilities, heating, ventilation, power, lighting, and communication systems will be provided. The building will be cooled by mechanical refrigeration. In addition, the decontamination area will require special ventilation, sewage retention tanks, and floor treatment. Energy conserving design will be utilized throughout the facility.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Medical facility
Lawrence Livermore National Laboratory
Livermore, California

2. Project No.: 85-R-706

8. Brief Physical Description of Project (continued)

Normal site utilities will be extended from mains and connections to storm and sanitary sewers will be made. Electrical power will be extended from high voltage feeders to a new substation serving this building. Area lighting will be installed for safety and security. Site development will comply with the Master Site Plan and will include grading, paving, off-street parking, curbs, gutters, sidewalks, fencing, security screens, and minimal landscaping.

9. Purpose, Justification of Need for, and Scope of Project

Adequate health service support to the over 7600 employees of Lawrence Livermore National Laboratory (LLNL) primarily consists of two major elements. First, preventative approaches to both the physical and mental health of the workforce. This is accomplished through performance of over 3500 physical examinations a year, attention to the potential hazards of one of the country's foremost applied physics and engineering facilities and support to those who may be unduly stressed by working in such an environment. Second, is the availability of adequate emergency response to a very broad spectrum of hazards ranging from intense radioactivity, through almost every possible chemical, mechanical and electrical risk, to the "normal" falls, cuts, etc., that go with a dynamic population that includes over a thousand contractor employees in addition to the LLNL staff. Although blessed with one of the best safety records of the national laboratories, the health services facility must be prepared for major incidents.

The current health facility is housed in a 40 year old World War II barracks building that is shared with the South Badge Office. It was barely adequate for a medical staff of less than 20 and a population of less than 5,000. Today the building limits physical examinations to approximately two thirds of the DOE guidelines for a laboratory of LLNL's size. Several other health services required by DOE order, DOT regulation, California code, American National Standards Institute (ANSI) standards, and LLNL policy are currently not being provided due to the physical restraints of the current building. For example, in the event of persons being contaminated with radioactive, toxic, or carcinogenic materials, they cannot be adequately treated without significant risk to the current facility and attending personnel. A special unit needs to be constructed to deal with this particular type of emergency situation. The present facility is generally not capable of handling a large variety of emergency situations nor a large number of casualties.

1. Title and location of project: Medical facility
Lawrence Livermore National Laboratory
Livermore, California

2. Project No.: 85-R-706

10. Details of Cost Estimate*

	Item Cost	Total Cost
a. Engineering, design, and inspection at approximately 13% of construction costs		$ 700
1) Title I & II	$ 400	
2) Title III	300	
b. Construction costs		5,550
1) Improvements to land including grading, paving, walks and landscaping	550	
2) Buildings Medical, 25,600 sq. ft. at $162 per sq. ft........	4,150	
3) Utilities, including mechanical, power, communications, storm and sanitary sewer.	850	
c. Standard equipment		140
d. Relocation cost		100
Subtotal		$ 6,490
f. Contingency at approximately 12% of other costs (except item a. and c. above)		810
Total estimated cost........		$ 7,300

*Based on complete conceptual design.

11. Method of Performance

This project will be designed and constructed under a procedure commonly referred to as turnkey contracting. The project will be competitively bid with each bidder submitting a design and cost proposal. Minor work will be performed by LLNL forces.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Medical facility
Lawrence Livermore National Laboratory
Livermore, California

2. Project No.: 85-R-706

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1985	FY 1986	FY 1987	FY 1988	Total
a. Total project costs						
1. Total facility costs						
a. Construction line item	$ 0	$ 196	$ 2,194	$ 4,804	$ 106	$ 7,300
b. CP&D	0	0	0	0	0	0
c. Expense funded equipment ..	0	0	0	0	0	0
d. Inventories	0	0	0	0	0	0
Total direct costs	$ 0	$ 196	$ 2,194	$ 4,804	$ 106	$ 7,300
2. Other project costs						
a. R&D necessary to complete construction	120	0	0	0	0	120
b. Other project related costs	0	0	0	0	0	0
Total other project costs	120	0	0	0	0	120
Total project costs	$ 120	$ 196	$ 2,194	$ 4,804	$ 106	$ 7,420

b. Other related annual costs (estimated life of facility: 40 years)

1. Facility operating costs	$ 230
2. Programmatic operating expenses directly related to the facility	3,280
3. Capital equipment not related to construction but related to the programmatic effort in the facility	300
4. GPP or other construction related to programmatic effort in the facility	100
5. Other costs	0
Total other related annual funding costs	$ 3,910

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Medical facility
Lawrence Livermore National Laboratory
Livermore, California

2. Project No.: 85-R-706

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13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

- a. Total project funding
    - 1. Total facility costs
        - a. Construction line item - No narrative required.
        - b. Expense funded equipment - No narrative required.
        - c. Inventories - No narrative required.
    - 2. Other project funding
        - a. R&D necessary to complete construction
          Total funding in this classification represents the conceptual design cost and other studies determined to be necessary.
        - b. Other related project cost - No narrative required.

- b. Total related-funding requirements

    1. Facility operating costs - Operating costs of the facility are estimated to be $226,000 per year including $92,900 escalation (based on FY 1982 average maintenance and utility cost of $5.20 per sq. ft. escalated to $8.83 in FY 1987. Maintenance cost escalated at 7% per annum, and utility cost escalated at 15% per annum).

    2. Programmatic operating expenses directly related to the facility - This estimate is for 32 total programmatic and support personnel at $102,540 average per person in FY 1987. Ninety percent of these people are presently housed in existing scattered buildings and trailers and will be moved to this new facility. The operating funds for these people are a normal part of the past and current programs. The remaining 10 percent represent growth projected to FY 1987. Funds for this growth have been included in program projections.

    3. Capital equipment not related to construction but related to the programmatic effort in the facility - This is an average annual estimate which includes both the small items needed for continuous operation of the facility and the occasional large item over $100,000 which cannot be described at this time, but can be predicted as needed to maintain technical excellence in efforts conducted in the facility.

1. Title and location of project: Medical facility
Lawrence Livermore National Laboratory
Livermore, California

2. Project No.: 85-R-706

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements (continued)

4. Maintenance, repair, GPP or other construction related to programmatic effort - None

5. Other costs - No narrative required.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MUTLIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES

(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project: Hanford site fire alarm system upgrade
Richland, Washington

2. Project No.: 85-R-707

3. Date A-E work initiated: 1st Qtr. FY 1985

3a. Date physical construction starts: 2nd Qtr. FY 1986

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: none
Date: none

6. Current cost estimate: $ 4,850
Less amount for PE&D: 0
Net cost estimate: $ 4,850
Date: September 1983

7. Financial Schedule

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1985	$ 4,850	$ 1,300	$ 1,300	$ 91
1986	0	1,708	1,708	2,078
1987	0	1,225	1,225	1,514
1988	0	617	617	1,167

8. Brief Physical Description of Project

This project provides for the design, procurement and construction of an upgraded fire alarm system which will be commensurate with required levels of protection for the Hanford Site. The project will replace all existing master alarm boxes and street boxes with radio boxes, replace alarm receiving equipment and consoles at the fire stations, and provide a computer aided dispatch system.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Hanford site fire alarm system upgrade
Richland, Washington

2. Project No.: 85-R-707

8. Brief Physical Description of Project (continued)

This project will replace approximately 240 master alarm boxes and 50 street boxes, which are distributed throughout the site. This will require additional equipment to interface the new master boxes with the existing detector circuits in the facilities. The existing alarm receiving equipment at the fire stations will be replaced with new equipment compatible with the new alarm boxes. Significant features of the new alarm receiving equipment includes printout of facility location and alarming zone within the facility. This equipment will be supplemented with a new computer aided dispatching system. This will increase the efficiency of responding emergency personnel by providing information not available with the existing system. This includes information such as type of occupancy, recommended extinguishing agents, and adjacent conditions.

9. Purpose, Justification of Need for, and Scope of Project

The purpose of this project is to update the existing fire alarm system with a more reliable and efficient system. There has been no significant overhaul of the Hanford fire alarm system since the site was originally established in the early 1940's. Some system components are approaching 50 years in age. Repair of components is difficult at best due to the lack of spare parts. Overhead conductors are generally in excess of 20 years old with significant amounts in excess of 30 years old. Due to the normal aging process the insulation of these conductors is brittle and breaks easily leaving conductors exposed and permitting faults in the system. In some locations, alarms are transmitted to the fire stations on underground conductors. Major portions of these lines are uncharted and are subject to dig-ups during construction and maintenance activities.

Due to deterioration and age of the system components, numerous false and nuisance alarms as well as ground faults occur. Records of alarm signals for calendar years 1979, 1980 and 1981 indicate alarms due to electrical problems, malfunctions, atmospheric phenomenon, and equipment failures ranged between 28 and 37 percent of the total number of alarms received. It is estimated that the proposed system could eliminate 50 percent of these alarms.

As the facilities at the site have been increased in size as well as number, additions to the fire alarm reporting system have been made to cover them. Unfortunately, by necessity, requirements of the National Fire Codes have been violated. These violations concern connection of detectors to master alarm boxes in an unacceptable manner, inadequate annunciation, and inappropriate alarm receiving at the fire stations.

CONSTRUCTION PROJECT DATA SHEET

1. Title and location of project: Hanford site fire alarm system upgrade
Richland, Washington

2. Project No.: 85-R-707

9. Purpose, Justification of Need for, and Scope of Project (continued)

The need for the fire alarm system upgrade is based on an audit report done in June 1982 by consultants specializing in fire protection and safety engineering. The audit report identifies 30 categories of deficiencies within the existing fire alarm system. An Engineering Study addressed alternative solutions for correcting existing deficiencies. Through the site survey, overall system analysis, and the consultant's fire alarm system expertise, it was concluded that to achieve compliance with National Fire Protection Association (NFPA), ensure system reliability, future flexibility and ease of operation, a Radio fire alarm system alone fulfilled these requirements.

Delay of this project will increase the risk of serious fire accidents due to continued aging of the system and its components. Also, maintenance costs of the existing system will continue to increase.

10. Details of Cost Estimate

		Item Cost	Total Cost
a.	Engineering design and inspection at approximately 13% of construction costs		$ 500
b.	Construction costs		3,720
	(1) Construction (includes equipment and labor)	$ 1,910	
c.	Standard equipment includes 6 consoles ($54,000/ea.) computer aided dispatch system ($204,000) and approximately 278 radio alarm boxes ($4,600/ea.)	1,810	
	Subtotal		$ 4,220
d.	Contingency at approximately 15% of above cost		630
	Total estimated cost............		$ 4,850

11. Method of Performance

Design, inspection, and construction will be accomplished by fixed-price contracts awarded on the basis of competitive bidding. It will be a design, procure and install contract as presently planned.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

Not required. TEC is less than $5,000,000.

CONSTRUCTION PROJECT DATA SHEET

1. Title and location of project: Hanford site fire alarm system upgrade
Richland, Washington

2. Project No.: 85-R-707

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Not required. TEC is less than $5,000,000.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABROATORIES-FACILITIES SUPPORT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES
(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project: Central chilled water plant
Argonne National Laboratory
Argonne, Illinois

2. Project No.: 85-R-709

3. Date A-E work initiated: 1st Qtr. FY 1986

3a. Date physical construction starts: 2nd Qtr. FY 1987

4. Date Construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: none
Date: none

6. Current cost estimate: $ 5,200
Less amount for PE&D: 0
Net cost estimate: $ 5,200
Date: September 1983

7. Financial Schedule

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1986	5,200	962	962	712
1987	0	3,600	3,600	3,000
1988	0	638	638	1,488

8. Brief Physical Description of Project

This project establishes a central water chilling plant to serve all the principal buildings in the central research group. Two new electric centrifugal chillers totaling 3200 tons are planned for a now-unoccupied area of the former Zero Gradient Synchrotron (ZGS) facilities. Use is made of existing cooling towers, pumps, piping, and electrical power. Approximately 3 miles of chilled water supply and return piping are routed to the user buildings. Local terminal connections are included. The connecting pipeline is specified as uninsulated, corrosion-resistant plastic pipe, buried below frost line. New chilled water circulation pumps are included for the control facility, with necessary pump modifications of the terminal delivery points.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water plant
Argonne National Laboratory
Argonne, Illinois

2. Project No.: 85-R-709

9. Purpose, Justification of Need for, and Scope of Project

The proposed project offers an integrated, cost-saving alternate to piecemeal replacing of worn out water chillers. The water chillers installed during construction of the Laboratory are beyond their normal life expectancy; to maintain active research operations, the ANL Institutional Plan, 1983-1988, identifies a nearly $6,000,000 program of chiller replacement. By establishing a central water chilling plant, greater reliability and more economical operations are possible. A 1977 ANL engineering study aimed at integrated water chilling facilities identified the savings and also pointed to savings possible by retiring steam-driven chillers in favor of electrical. However, when combined with the unavoidable necessity of replacing worn out chillers, the central plant concept is definitely attractive, offering both immediate benefits and greatly enhanced potentials. The annual estimated savings in energy, repair, and maintenance, in 1983 dollars, is approximately $500,000 for providing a central chilled water plant to replace eight existing steam driven chillers in the above mentioned four buildings.

In addition to the benefits of central chilled water supply, this project makes use of existing facilities: i.e., the vacant area in Building 370 and the under-utilized electric substations and pumped cooling tower water lines from the cooling tower near Building 370. If these under-utilized facilities were not available, a new building for the central chillers complete with new cooling towers, pumps, and electrical substation would have to be constructed at an additional cost to the project of $763,000. The capacity built into the existing facilities will accommodate the central chilling concept, yet allow a generous margin to attract future research programs. Superimposing the water chilling function offers assurance that the existing facilities will remain profitably available in good condition.

10. Details of Cost Estimate

	Item Cost	Total Cost
a. Engineering, design and inspection at 18% of construction, Item b		$ 600
b. Construction costs		3,270
(1) Valve pits	$ 135	
(2) Trenching and backfill	460	
(3) Buried chilled water piping	1,280	
(4) Piping and equipment within buildings	1,170	
(5) Controls and metering	60	
(6) Electrical power for chillers and pumps	165	
Subtotal		$ 3,870

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water plant
Argonne National Laboratory
Argonne, Illinois

2. Project No.: 85-R-709

10. Details of Cost Estimate (continued)

	Total Cost
c. Procurement costs (chillers, primary pumps & strainer)	600
d. Contingency - 16.3% of engineering, construction & procurement	730
Total estimated cost	$ 5,200

11. Method of Performance

Engineering, design and inspection will be performed by laboratory engineering personnel, aided by outside A/E firms. Construction will be accomplished by fixed-price contract awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1986	FY 1987	FY 1988	Total
a. Total project costs					
1. Total facility costs					
(a) Construction line item	$ 0	$ 750	$ 3,000	$ 1,450	$ 5,200
(b) PE&D	0	0	0	0	0
(c) Expense funded equipment	0	0	0	0	0
(d) Inventories	0	0	0	0	0
Total facility costs	$ 0	$ 750	$ 3,000	$ 1,450	$ 5,200
2. Other project costs					
(a) R&D necessary to complete construction	0	0	0	0	0
(b) Other project related costs	20	0	0	0	20
Total other project costs	$ 0	$ 0	$ 0	$ 0	$ 0
(Items 1 and 2)	$ 20	$ 750	$ 3,000	$ 1,450	$ 5,220

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water plant
   Argonne National Laboratory
   Argonne, Illinois

2. Project No.: 85-R-709

12. Funding Schedule of Project Funding and Other Related Funding Requirements (continued)

    b. Total related funding requirements (estimated life of project: 20 years) - N/A

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

    a. Total project funding
       1. Total facility costs (N/A)

       2. Other project funding
          (a) No R&D effort is required
          (b) $20,000 spent for conceptual design

    b. Total related funding requirements - The central water chilling facility to be established will have a useful lifetime upwards of 20 years.

       1. Facility operating costs - Implementation of this project will replace existing physical functions within individual buildings with a central plant. This will result in a reduction of maintenance and operating costs while restoring an acceptable level of operational efficiency to existing facilities, thus the facility operating cost is reported as zero.

       2. Activity operating expenses directly related to the facility - Although this project will restore and replace general purpose facilities employed to perform a wide variety of activities, there is no activity operating expense directly related to, or required for support of this project, thus the activity operating expense is reported as zero.

       3. Capital equipment not related to construction but related to the activity effort in the facility - None.

       4. GPP or other construction related to activity effort - None

       5. Other costs - None

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Central chilled water system restoration
Oak Ridge National Laboratory, Tennessee

2. Project No.: 85-R-712

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3. Date A-E work initiated: 1st Qtr. FY 1985

3a. Date physical construction starts: 1st Qtr. FY 1986

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $ 4,700
Less amount for CP&D: 0
Net cost estimate: $ 4,700
Date: September 1983

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7. Financial Schedule

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1985	$ 4,700	$ 1,000	$ 1,000	$ 556
1986	0	1,058	1,058	862
1987	0	2,600	2,600	2,240
1988	0	42	42	1,042

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8. Brief Physical Description of Project

This project will remove from service three obsolete 600 ton chiller units located in the Central Research and Administration Complex and provide replacement capacity. The Central Compressor Facility structure will be expanded, if required, for the installation of 2,000 ton centrifugal chiller and the associated pumps, controls, and piping. Concurrently, the cooling tower system supplying condenser water to the facility will be upgraded to correct a marginal capacity condition during peak demand periods.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water system restoration
Oak Ridge National Laboratory, Tennessee

2. Project No.: 85-R-712

9. Purpose, Justification of Need for, and Scope of Project

The purpose of this project is to: replace three 600 ton chiller units due to age, condition, and limited capacity; increase capacity of a marginal cooling tower system.

The Central Research and Administration Complex consists of seven major facilities with approximately 1,000,000 sq. ft. of floor space and approximately a third of the Laboratories' research personnel. The space is used by multi-discipline groups and supporting service divisions participating in applied and basic research programs.

The units to be replaced were obtained from surplus channels in 1952 and are now approximately 35 years old. Their reliability continues to decline, and, in recent years, two of the three machines have been out of service for several weeks or more. Repair parts are no longer stocked by the manufacturer and downtimes are extended by the need to custom fabricate the necessary parts.

The declining reliability of these machines will continue and more frequent interruptions and greater delays to programmatic activities can be anticipated. Many programmatic activities are dependent on computer services and the ORNL Computer Center located in the area served by the 600 ton chillers.

10. Details of Cost Estimate*

	Item Cost	Total Cost
a. Engineering, design, and inspection at approximately 12% of construction costs, item b.		$ 450
b. Construction costs		3,700
(1) Land improvements including grading, landscaping	$ 43	
(2) Building addition (2,500 sq. ft. @ $153/sq. ft.)	362	
(3) Building modifications (concrete work, etc.)	131	
(4) Other structures (cooling tower)	419	
(5) Special facilities (chiller, pumps, piping, etc.)	2,745	
Subtotal		$ 4,150
c. Contingency at approximately 13% of above costs		550
Total estimated cost		$ 4,700

*Cost estimate based on completed conceptual design.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Central chilled water system restoration
Oak Ridge National Laboratory, Tennessee
2. Project No.: 85-R-712

11. Method of Performance

Design and inspection will be on the basis of a negotiated architect-engineer contract. Construction and procurement will be accomplished by fixed-price contracts and subcontracts awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

Not required. TEC is less than $5,000,000.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Not required. TEC is less than $5,000,000.

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MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES PROGRAM
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Fire protection improvements (phase II)
Brookhaven National Laboratory (BNL)
Upton, New York

2. Project No.: 86-R-726

3. Date A-E work initiated: 2nd Qtr. FY 1986

3a. Date physical construction starts: 3rd Qtr. FY 1986

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $ 3,000
Less FY 1984 PE&D: 0
Net cost estimate: $ 3,000
Date: December 1984

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1986	$ 3,000	$ 481	$ 481	$ 281
1987	0	2,500	2,500	1,700
1988	0	19	19	1,019

8. Brief Physical Description of Project

This project provides for the design, fabrication and installation of various fire protection improvements affecting over 210,000 sq. ft. of building space. The improvements consist of:

1. Providing automatic sprinkler protection in basement, laboratories and storage areas of facilities designated as high loss potential areas. Areas included are Building 510, 555, 815, 830, 901 and 928.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Fire protection improvements (phase II)
Brookhaven National Laboratory (BNL)
Upton, New York

2. Project No.: 86-R-726

8. Brief Physical Description of Project (continued)

2. Provide complete or partial automatic sprinkler protection (either new, or extension of existing systems) in buildings of combustible contents and/or construction which have a direct impact or exposure to DOE programs. These include Buildings 130, 179, 211, 355, 356, 480, 610 and 923.

3. Transferring the existing fire alarm panels from BNL's old telegraph system to BNL multiplexed central alarm station (completion of a multiplexed central alarm station is scheduled in FY 1985). This will eliminate basic operational deficiencies in the existing system and bring BNL into full compliance with general industrial standards and DOE guidelines.

4. Raising the level of fire protection at Building 30 (Brookhaven Center) and other miscellaneous buildings to improve the life safety aspects. These improvements include: modifications to exits to comply with the National Fire Protection Association (NFPA) 101 (the Life Safety Code), extending sprinkler protection into unprotected areas, installing fire extinguishing systems above localized areas of high hazards (i.e., grills, deep fat fryers).

All installations and modifications will be in accordance with DOE recommended standards. Specifically, sprinkler protection will conform to National Fire Protection Association Standard 13. Sprinkler systems will be hydraulically designed to minimize costs. Wetpipe system on 100 sq. ft. spacing will be used in heated areas. Dry pipe systems will be used for unheated or partially heated areas. Water supplies will be taken from the existing BNL site water distribution system.

Transferring the fire alarm system to BNL's new central station facility will include all the work necessary to comply with the National Fire Code's 72 Series and DOE Orders.

9. Purpose, Justification of Need for, and Scope of Project

The purpose of this project is to reduce the risk of loss due to fire at BNL. Only key facilities have been included. Key facilities are defined as:

a. Buildings containing operations directly involved in DOE program activities; or

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Fire protection improvements (phase II)
Brookhaven National Laboratory (BNL)
Upton, New York

2. Project No.: 86-R-726

9. Purpose, Justification of Need for, and Scope of Project (continued)

b. Vital support buildings for program buildings

Each key facility was examined in relation to several interrelated risk factors: potential dollar loss due to fire, effectiveness and reliability of existing fire protection (if any), amount of combustibles present, type of potential fire (i.e., smokey, flash, average), access by fire department, salvageability, potential extension of fire, impact on experiments, and life safety of occupants. Automatic sprinkler protection has been proposed over fire detection since the above factors were especially unfavorable (i.e., difficult fire department access, over one million dollars loss potential, potential fire spread is great, program impact is severe).

The Gamewell telegraph portions of the system are in excess of 25 years old. Maintenance is high, alarm information provided is limited, expansion is limited and costly. The telegraph system does not indicate when a field unit resets nor does it indicate when a local system is in trouble. Transferring the fire alarm from the Gamewell System to the new multiplexed system will satisfy DOE requirements and provide an easy expandable, economical alarm system.

10. Details of Cost Estimate

	Item Cost	Total Cost
a. Engineering, design, and inspection at approximately 12% of construction costs, item b		$ 285
b. Construction costs		2,370
1. Sprinkler system installation into existing building (approximately 210,000 sq. ft. at $360/head)	$ 1,125	
2. 13 new water mains with trenching control valves and wet taps (approximately 1,200 feet at $90 per ft.)	219	
3. Connect sprinkler alarms into existing fire alarm system (15 risers at $8,400 each)	126	
4. Transfer fire alarm to new site protective signaling system (150 buildings at $6,000 each)	900	
Subtotal		2,655
c. Contingency at approximately 13% of above costs (Items a & b)		345
Total estimated cost		$ 3,000

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Fire protection improvements (phase II)
Brookhaven National Laboratory (BNL)
Upton, New York

2. Project No.: 86-R-726

11. Method of Performance

Design and inspection will be performed under one or more negotiated architect-engineer contracts with firms specializing in fire protection design. Construction and procurement will be accomplished by fixed-price contracts and purchase orders awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

Not required.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Not required.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
ENERGY MULTIPROGRAM LABORATORIES-GENERAL PURPOSE FACILITIES
(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and location of project: Laboratory restoration I
Richland, Washington

2. Project No.: 87-R-751

3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 4th Qtr. FY 1987

4. Date Construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: None

6. Current cost estimate: $ 2,100
Less amount for PE&D: 0
Net cost estimate: $ 2,100
Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1987	$ 2,100	$ 2,100	$ 2,100	$ 400
1988	0	0	0	1,690
1989	0	0	0	10

8. Brief Physical Description of Project

The existing first stage of two stages of air filtration in the radioactive ventilization exhaust system of a major 300 Area analytical chemistry facility uses disposable High Efficiency Particulate Air (HEPA) filters that are inserted into permanent, sheet-metal filter housings. The air that is being filtered is drawn from gloveboxes and hoods in which radioactive materials are used. This project will remove approximately 140 of the existing, obsolete filter housings and replace them with new support stands, ductwork, and instrumentation that will allow self-contained, disposable filter units to be used. The housings, ductwork and used filters removed by the project will be suitably packaged and disposed. The initial set of new, self-contained filters will be supplied by the project.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Laboratory restoration I
Richland, Washington

2. Project No.: 87-R-751

9. Purpose, Justification of Need for and Scope of Project

The analytical chemistry facility is used for chemistry studies of radioactive materials. In order to comply with the release limits for radionuclides to the environment given in DOE Order 5480.1, Chapter XI, two stages of filtration must be provided for air exhausted from hoods and gloveboxes in which radioactive materials are used. The two stages satisfy the combined requirements for release limits and reliability during normal and accident conditions. This project, by replacing 140 obsolete filter housings, will complete replacement of all the first stage filters in the building with modern, air tight filter housings.

Over the life of the facility, virtually every radionuclide has been present in the gloveboxes and hoods served by the exhaust system that this project will modify. Large quantities of fissile materials, mixed fission products, and radioactive metal scrap (from reactor fuels) are routinely handled in the facility. The presence of these different radioactive materials, in significant quantities, requires that the ventilation system operate and be maintained in a very safe condition. Assuring that there is a high confidence level in the reliability of the system under both normal and accident conditions.

The existing filter housings are mechanically worn to the point that some are very difficult to seal. Air can leak between the filter and the frame, thus allowing contamination to spread into the duct work downstream from the filters. Then the filter is sealed properly, air is prevented from leaking past the filter and contamination is caught on the filter rather than being trapped downstream on the larger, secondary building filters. The seal problem is encountered both when new filters are installed and while filters are in service. At a given time, between 10% and 15% of the filters may fail to pass required performance tests. Loss of seal during operation reduces the effectiveness of the exhaust system, and may result in a release of contamination into downstream duct work between the primary and secondary filters. Correcting the seal problems results in decreased operating costs. The proposed system will assure total sealing and reduce filter changes by operations personnel to as low as reasonably achievable (ALARA) radiation exposure conditions, which is not possible with the existing housings.

The impact of not proceeding with this project will be to not allow operational and maintenance personnel to meet the ALARA radiation exposure. There would also be a higher potential for radioactive release from the building during an accident condition and the stoppage of all work in the building.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Laboratory restoration I
Richland, Washington

2. Project No.: 87-R-751

9. Purpose, Justification of Need for, and Scope of Project (continued)

Because of many filter boxes, ventilation ducts, overhead piping and wire chases, the surface area on which contamination could be deposited is very large. A release of contaminated particles in the basement would be extremely difficult and expensive to clear up. With many of the past R&D programs processed in the building, costs could have gone into the million dollar range to restore proper conditions. This project will reduce that risk to something that is minimal when utilized with proper filter changing.

10. Details of Cost Estimate[a]

	Item Cost	Total Cost
a. Engineering, design and inspection at approximately 6% of construction costs, item b		$ 100
b. Construction costs		1,620
(1) Improvements to land	$ 0	
(2) Building services modifications	1,620	
(3) Utilities	0	
(4) Equipment	0	
c. Contingency at approximately 23% of above costs		380
Total estimated cost		$2,100

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[a] This estimate is based on 100% completion of conceptual design.

11. Method of Performance

Design and inspection will be performed by the onsite architect-engineer. Construction and procurement will be accomplished by the onsite cost plus award fee (CPAF) contractor for the radioactive work.

12. Funding Schedule of Project and Other Related Funding Requirements

Not required.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Not required.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMEN
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES PROGRAM

(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Piping system restoration
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-752

3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 1st Qtr. FY 1988

4. Date construction ends: 2nd Qtr. FY 1989

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $3,800
Date: January 1985

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1987	$ 3,800	$ 725	$ 725	$ 360
1988	0	3,075	3,075	1,855
1989	0	0	0	1,585

8. Brief Physical Description of Project

This project contains three parts:

- The replacement, refurbishment, or upgrading of unreliable or overloaded utility piping distribution systems currently serving Oak Ridge National Laboratory (ORNL) facilities located in the Y-12 Plant. The outdated piping distribution systems included in the project are no longer efficiently repaired. They include steam, cooling-tower water, and demineralized water. In addition to pipe replacement, valves, filters, pumps, and motors will also be replaced.

- The addition of a demineralizer and feed water charcoal filter to the central demineralized water system in order to provide a continuous supply of demineralized water adequate to meet ORNL at Y-12 requirements.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Piping system restoration
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-752

8. Brief Physical Description of Project (continued)

- The installation of a new air compressor and dryer with a capacity of 3,000 cubic feet per minute (cfm) in the central instrument air system to provide air to critical operations. This unit is needed to meet existing requirements of ORNL at Y-12.

9. Purpose, Justification of Need for, and Scope of Project

The purpose of this project is to restore two critical utilities supporting ORNL at Y-12 to an appropriate level of reliability and capacity, thus minimizing the adverse consequences of potential system failures or curtailments on research activities.

ORNL at Y-12 facilities are supplied utility services from central systems operated by the Y-12 Utilities Department. These systems consist of many pieces of equipment and distribution networks that predate ORNL's presence in Y-12. As such, the systems were installed and maintained primarily in support of weapon component production. ORNL facilities have been provided these utility services because the ORNL divisions occupy buildings that formerly housed weapons-related activities. Relatively few ORNL capital or programmatic funds have been spent to expand or renovate the distribution networks, to enlarge system capacity, or to replace worn or obsolete equipment.

Since 1980, the Y-12 Plant has been systematically replacing several worn or unreliable pieces of equipment, including compressors that supply the central systems. However, this replacement has occurred almost exclusively in the portion of Y-12 dedicated to weapons components production. Old compressors in the ORNL portion of the plant are not currently scheduled for replacement.

Two systems of specific interest, instrument air and demineralized water, are structured so that the two areas which they serve can be separated. In emergency situations, demineralized water can be totally shut off to ORNL facilities, and the instrument air distribution network valves so ORNL facilities will be solely dependent on an inadequate, 30-year-old compressor.

1. Title and location of project: Piping system restoration
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-752

9. Purpose, Justification of Need for, and Scope of Project (continued)

The demineralized water system currently is being upgraded by the Y-12 Plant to a 200-gallon-per-minute (gpm) production rate. However, backup capacity during demineralizer regeneration is only 100 gpm. The 200 gpm will supply both Y-12 and ORNL facility requirements, but 100 gpm will not. During regeneration of the primary demineralizer, it is to be expected that demineralized water to ORNL facilities will, on occasions, be curtailed. Depending on the type of feed water used (condensate, softened water, or process water), regeneration can occur as often as once a day using process water or once every 4 to 6 days using softened water. The Biology, Fusion Energy, and Engineering Technology divisions, and the Isotope Enrichment Group of the Operations Division use demineralized water in various experimental and operational activities. A prolonged shutdown of demineralized water would have a significant negative impact on all four divisions.

The proposed demineralizer (100-gpm capacity) will be installed in the central demineralized water plant to ensure a continuous 200-gpm production rate. It is vital to ORNL research objectives that the proposed demineralizer and filter be installed to ensure a reliable supply of demineralized water.

The instrument air compressors being replaced by Y-12 are in the production portion of the plant. The new units are sized only to meet production requirements and do not include capacity for ORNL facilities. Despite this replacement program, the newly defined instrument air requirements and the continued existence of several old and unreliable compressors makes doubtful a secure supply of instrument air unless ORNL invests in the system capacity.

The reciprocating compressor to be replaced has a nominal 1,500 cfm capacity. As is typical of a reciprocating-type compressor of its age, this compressor needs an extensive annual overhaul to prolong its life. Immediately after the overhaul, the compressor produces 1,500 cfm; but in a period of about 2 months, this capacity deteriorates to approximately 1,000 cfm.

1. Title and location of project: Piping system restoration
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-752

9. Purpose, Justification of Need for, and Scope of Project (continued)

ORNL facilities require approximately 3,000 cfm, and the new compressor is sized to meet this requirements. Only by investing in a new compressor of this size can ORNL ensure a reliable and adequate supply of instrument air. The integration of this instrument air into research and production activities by using in pneumatic control systems, equipment operation, cooling, test and inspection, and various support activities makes the installation of this new compressor vital to the accomplishment of ORNL objectives.

Based on engineering assessments, the continued operation of laboratory facilities is vulnerable to other unreliable utility piping distribution systems that have not been systematically upgraded since their installation in the 1940's. Though recognized as an urgent need, the work has not been possible, except on a piecemeal basis, under prevailing budget limitations. Renovations and upgrading of the utility piping distribution systems will enhance the inherent capability of these facilities over the long term. Systems that can be categorized as unreliable include the tower-water distribution and recirculating-demineralized water distribution systems serving the Isotope Separations building. These systems date back to the mid-1940's. Since that time, upgrading has occurred through routine or emergency maintenance. Valve gates have rusted and no longer seal. Filters have deteriorated such that internal element supports are not functional.

A major steam-control station providing process and heating steam to the Fusion Energy Administration and Laboratory facility does not provide adequate control and experiences frequent outages requiring much maintenance. Recirculating-demineralized water pumps serving the Fusion Energy and Engineering Technology building are about 30 years old and require expensive, time-consuming repairs because replacement parts are no longer available and must be shop fabricated.

The utility systems serving ORNL at Y-12 cannot be considered as separate systems from the Y-12 utility system. The systems were installed in the 1940's as continuous systems designed to serve the site as a whole. In the portion of Y-12 not occupied by ORNL, the system's condition reached the critical point in FY 1979, and refurbishment was approved starting in FY 1980. The same risks apply to these ORNL facilities within Y-12, which were constructed during the same time period.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Piping system restoration
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-752

9. Purpose Justification of Need for, and Scope of Project (continued)

Considering the importance of the research programs and the magnitude of the total investment, it is important that the reliability of piped utility services for these facilities be restored to original status and, in many cases, modified to accommodate current levels of use.

10. Details of Cost Estimate*

	Item Cost	Total Cost
a. Engineering, design, and inspection at approximately 15% of construction costs, item b		$ 401
b. Construction costs		2,756
(1) 4000 building modifications	$ 684	
(2) Special facilities	2,072	
Subtotal		3,157
c. Contingency at approximately 20% of above costs		643
Total estimated costs		$ 3,800

11. Method of Performance

Design and inspection will be performed under a negotiated architect-engineer contract. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bids.

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*The above estimate is based on a completed conceptual design.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Piping system restoration
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-752

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12. Funding Schedule of Project Funding and Other Related Funding Requirements

Not required; total estimated cost is less than $5,000,000.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Not required.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
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ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES PROGRAM
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Rehabilitate laboratory space
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-753

3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 1st Qtr. FY 1988

4. Date construction ends: 3rd Qtr. FY 1990

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $ 12,035
Less amount for PE&D: 0
Net cost estimate: $ 12,035
Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1987	$ 12,035	$ 1,235	$ 1,235	$ 1,235
1988	0	3,600	3,600	2,000
1989	0	3,600	3,600	4,100
1990	0	3,600	3,600	4,700

8. Brief Physical Description of Project

This project is the first phase of a two phase project that will rehabilitate a large multipurpose laboratory and office building at ANL (Building 200). The 359,600 gross square feet brick structure was put into service in 1951 and has a replacement value of $86,100,000 and an expended useful life of 60%. Phase I will rehabilitate wings A-F, which totals 166,000 gross square feet of space. The remainder of the building will be renovated in phase II.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Rehabilitate laboratory space
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-753

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8. Brief Physical Description of Project (cont'd.)

The workscope will encompass essentially all aspects of building construction, except structure and roofing[1], including (as needed): building envelope (windows, tuckpointing); building interiors (painting, partition, floor tile, ceiling tile); electrical main distribution systems (transformers, switchgear, wiring); lighting (panels, fixtures, wiring), heating ventilation and air conditioning (HVAC) (pumps, fans, filters, coils, heat exchangers, air compressors, controls, ductwork, piping[2]); plumbing (toilet fixtures, water heaters, pumps, water and drain piping); laboratory and process piping (water heaters, distilled water system, air compressors and driers, nitrogen and oxygen storage tanks and evaporators, gas, water and drain piping); elevators (hydraulics controls cabs); removal and disposal of potentially contaminated or hazardous materials such as exhaust ductwork, laboratory drain piping and asbestos insulation.

9. Purpose, Justification of Need for, and Scope of Project

By the time this project is funded, the building will have been in constant use as a major laboratory and office building for more than 35 years. The needs of scientific programs have changed dramatically in this time period. The facility does not meet current construction codes and safety standards. In addition, systems that provide electric power, process fluids, heating, cooling, humidity control, clean air delivery and laboratory exhaust for control of hazardous materials are becoming less reliable each year because of aging. Adequate maintenance is difficult and very costly because replacement parts for many of the components are no longer available and shop effort is required for temporary repairs.

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[1] Included under on-going Project No. 85-R-702 "Replace Laboratory Roofs".
[2] Chillers and cooling towers are included under Project No. 85-R-709 "Central Chilled Water System "Phase I".

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Rehabilitate laboratory space
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-753

9. Purpose, Justification of Need for, and Scope of Project (cont'd)

The need exists, therefore, for a total upgrade of the building as described in the work scope above. If this facility upgrade is not supported, maintenance effort to keep the facility in an operational condition can be expected to continuously increase. Shutdowns due to major building equipment failures can be expected to cause major interruptions in current and future R & D activities and require long term experiments to start again. Health, safety, security and environmental risks will continue to increase. Personnel morale and productivity are also likely to be adversely affected.

10. Details of Cost Estimate*:

	Total Cost
a. Engineering, design, and inspection at approximately 17% of construction costs, item b	$ 1,530
b. Construction costs	9,000
c. Contingency at approximately 14% of above costs	1,505
Total estimated cost	$ 12,035

*Based upon a completed conceptual design and current cost data.

11. Method of Performance

Engineering, design and inspection will be performed by Laboratory engineering personnel, aided by outside A/E firms. Construction will be accomplished by fixed-price contract awarded specializing in fire protection design. Construction and procurement will be accomplished by fixed-price contracts and purchase orders awarded on the basis of competitive bidding.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Rehabilitate laboratory space
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-753

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1987	FY 1988	FY 1989	FY 1990	Total
a. Total project costs						
1. Total facility costs						
(a) Construction line item	$ 0	$ 1,235	$ 2,000	$ 4,100	$ 4,700	$12,035
(b) PE&D	0	0	0	0	0	0
(c) Expense funded equipment	0	0	0	0	0	0
(d) Inventories	0	0	0	0	0	0
Total direct costs	$ 0	$ 1,235	$ 2,000	$ 4,100	$ 4,700	$12,035
2. Other project costs						
(a) R&D necessary to complete construction	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
(b) Other project related costs	51	0	0	0	0	51
Total other project costs	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total project costs (Item 1 and 2) .	$ 51	$ 1,235	$ 2,000	$ 4,100	$ 4,700	$12,086

b. Other related annual costs (estimated life of project: 20 years

1. Facility operating costs	$ 0
2. Activity operating expenses directly related to the facility	0
3. Capital equipment not related to construction but related to the programmatic effort in the facility	0
4. GPP or other construction related to programmatic effort in the facility........................	0
5. Other costs	0
Total related annual costs..	0

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Rehabilitate laboratory space
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-753

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13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding
   1. Total facility
      (a) Construction line item - No narrative required
      (b) PE&D - None
      (c) Expense funded equipment - None
      (d) Inventories - None
   2. Other project funding
      (a) No R&D effort is required
      (b) $51,000 spent for conceptual design

b. Other related funding requirements

   1. Facility operating costs - Rehabilitation of this facility will increase energy efficiency and greatly lower operating costs, thus the facility operating cost is given as zero.

   2. Activity operating expenses directly related to the facility - There is no activity operating expense directly related to, or required for support of this project, thus the activity operating expense is given as zero.

   3. There is no capital equipment related to the activity effort, not related to construction.

   4. GPP or other construction related to activity effort - None

   5. Other costs - None

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MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES PROGRAM
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Mechanical systems rehabilitation
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-755

3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 4th Qtr. FY 1987

4. Date construction ends: 1st Qtr. FY 1989

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $ 3,200
Less amount for PE&D: 0
Net cost estimate: $ 3,200
Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1987	$ 3,200	$ 1,100	$ 1,100	$ 1,060
1988	0	2,100	2,100	1,590
1989	0	0	0	550

8. Brief Physical Description of Project

This project will restore worn parts of the central heating ventilation and air conditioning (HVAC) systems in three large office and laboratory buildings, Building 203, Building 205, and Building 212. Forty-three large field fabricated walk-in type air handling units require extensive rebuilding. These units range in size from 8,000 to 30,000 cfm (each roughly 25 to 75 tons of refrigeration capacity). Each provides ventilation air and climate control to a large bank of experimental laboratories and their adjacent offices. Required work is as follows:

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Mechanical systems rehabilitation
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-755

8. Brief Physical Description of Project (cont'd.)

Chilled Water Coils: The air handling units selected for overhaul are those with steel coil frames rusted through. The frames no longer support the coils, nor do they prevent untreated air from bypassing the coils. Replacement entails providing adjacent coil blank-off panels, new local piping, and vapor-proof exterior insulation over the new parts.

Preheat Coils: This project will replace all preheat coils in the selected air-handling units with glycol-filled coils. The existing steam coils require replacing because of corroded frames. The poor performance of the aged steam coils and the resulting downstream damage to the systems makes renovation with new technology urgent. Replacement must include new coil supports, steam-to-glycol heat exchangers at selected locations, appropriate changes in the control hardware, new local piping and associated pipe insulation.

Filters: Replacement of selected filter banks within the air handling units is included in the project scope. Those selected for replacement are located downstream of the coils they are intended to protect. Their location and rusted condition have made them maintenance liabilities, and their low-tech filtering efficiency is no longer adequate for the scientific programs which rely on them. Replacement must include current-technology automatic 85% efficiency filters, appropriate sheet metal modifications to accommodate the change, some modifications of electrical conduit and wiring, and associated monitoring instruments.

Sheet Metal: Sheet metal parts downstream of the cooling coils will be replaced. They are corroded from moisture carry-over. Coil drain pans, metal floors and the lower parts of the housings require repair or replacement to maintain airtightness. Upstream portions of the housings are generally in good condition and represent a considerable asset compared with the cost of all-new air handling assemblies.

Controls: Existing 3-way chilled water control valves are worn obsolete types. They will be replaced with energy-efficient 2-way valves. Associated control components of obsolete manufacture and poor parts availability have been marked for replacement.

Painting: All exposed new work will be painting.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Mechanical systems rehabilitation
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-755

8. Brief Physical Description of Project (cont'd.)

Packaged Units: In addition, six packaged air conditioning units deemed to be rusted beyond reasonable repair will be replaced in total. Eight other salvageable packaged units will be equipped with glycol preheat coils and rusted filter sections will be replaced.

9. Purpose, Justification of Need for, and Scope of Project

The three buildings in question are large permanent brick laboratory-office buildings, each housing from 200 to 340 people and serving important scientific research programs such as the tandem-linac, battery development, laser projects, basic energy sciences and nuclear energy studies. The mechanical components providing the essential ambiance control for the scientists are from 25 to over 30 years old and have served their normal useful lives (20 to 25 years is average, according to DOE Life Cycle Costing guidelines). Cooling, humidity control, and clean air delivery are no longer reliable. Large scale unprecedented low chilled water flows in these buildings have been traced to unreliable preheat performance, in turn causing downstream coil freezing, frequent system drainage, extraordinary pipe corrosion, and widespread clogging of small water passages. Correction is urgent.

The air systems included in this project comprise approximately one-half of the total units for the three buildings. Units that can be temporarily restored by strategic coil replacement and those units showing little deterioration have not been included in this list and will be assigned for future attention when required.

The extent of so much simultaneous use and aging carries the scope of renewal beyond available operating funds; capital funding is required. Because of the close inter-relation of components it is more cost effective to completely rebuild each central unit instead of replacing parts piecemeal. The one obvious alternative of abandoning these failing systems amounts to an unreasonable condemnation of large investments in otherwise very high quality permanent research facilities. A second alternative of buying all new air handling facilities is undesirable from a research-interruption viewpoint and is considered unnecessarily expensive. The third known alternative, of piecemeal parts replacement is the one now in use. Proper use of operating funds under acceptable accounting procedures limits both the character and the extent of permissible renovation. The result of this alternative is marginal reliability and poor return for effort and expense.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Mechanical systems rehabilitation
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-755

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9. Purpose, Justification of Need for, and Scope of Project (cont'd.)

Thoughtful preplanning of rebuilding offers opportunities to use current technology to improve reliability (glycol preheat) and save energy (2-way control valves and improved control cycles). Overall, the project will release operating people from intensive breakdown maintenance and allow a return to more reasonable maintenance planning for the units involved.

10. Details of Cost Estimate*:

	Item Cost	Total Cost
a. Engineering, design, and inspection at 15% of construction costs, item b		$ 353
b. Construction costs		2,373
c. Demolition and removal and debris		59
Subtotal		$ 2,785
d. Contingency at 15% of above costs		415
Total estimated costs		$ 3,200

11. Method of Performance

Design and inspection will be performed by ANL personnel assisted by outside engineering services. Construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bidding.

*Based upon a completed conceptual design and current cost data.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Mechanical systems rehabilitation
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-755

12. Funding Schedule of Project Funding and Other Related Funding Requirements

Not required, TEC is less than $5,000,000.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Not required.

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MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES PROGRAM
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Water line replacement
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-756

3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 1st Qtr. FY 1988

4. Date construction ends: 4th Qtr. FY 1989

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $ 5,200
Less amount for PE&D: 0
Net cost estimate: $ 5,200
Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1987	$ 5,200	$ 1,000	$ 1,000	$ 400
1988	0	2,000	2,000	2,100
1989	0	2,200	2,200	2,700

8. Brief Physical Description of Project

This project will rehabilitate all of the deteriorated water lines which serve permanent buildings and areas at Argonne National Laboratory (ANL). Approximately 18 miles of cast iron water line in the size range of 2 inches to 18 inches will be replaced. The new water lines will consist of polyvinyl chloride (PVC) and reinforced concrete pipe (RCP) approved for potable water distribution and cast iron valves and fittings with cathodic protection.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Water line replacement
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-756

9. Purpose, Justification of Need for, and Scope of Project

This project is proposed because the water lines at ANL will become unreliable for fire protection use and Laboratory operations by 1990. Replacement of the water line will restore the reliability necessary for fire safety and efficient Laboratory operations.

Due to soil-side corrosion and graphitization of the cast iron pipe (determined by metallographic analysis), the water lines have reached the end of their useful life in most sections. The water lines will experience pipe breaks at an increasing rate as they age and are subjected to changes in stress caused by temperature changes or nearby excavation. The high frequency of pipe breaks will result in water supply outages to major buildings for two reasons: 1) increased number of simultaneous pipe breaks so that buildings with water supply from two directions in the grid will have both supplies cut off; 2) the cast iron pipe has become so weak that it cannot be repaired with a sleeve and replacement of an entire section typically requires one week.

The history of pipe breaks of the potable water system at ANL was analyzed by a corrosion consultant , C. P. Dillion and Associates, in 1979. The frequency of pipe breaks follow a semilogarithmic curve typical of corrosion and aging in case iron pipe. Over 100 pipe breaks per year are projected to occur in 1986 and beyond. Projections to 1983 have proven accurate. By 1990 the fire distribution system will not supply water reliably for fire protection use.

The Laboratory has three water distribution systems: a) domestic/fire (14.8 miles), b) laboratory (3.3 miles), c) canal (5.5 miles). The majority of the domestic/fire and laboratory water lines were installed in 1950; the canal water lines were installed in 1963. Since the laboratory and canal water lines run parallel to the fire/domestic lines in most areas, replacing all three lines simultaneously is economical. Although the canal lines are only 20 years old, they have become heavily scaled and no longer deliver the rated volume of water. During the summer, several buildings are not supplied with sufficient cooling water requiring supplemental feed from the domestic/fire system. In 1980, acid cleaning of the canal lines was investigated by a commercial firm; acid cleaning on a test sample failed to remove the scale safely. Replacement of the canal lines will return the canal system to its rated capacity. Since 1983, the canal water treatment has been modified so that in the future treatment water will no longer scale the lines.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Water line replacement
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-756

9. Purpose, Justification of Need for, and Scope of Project (cont'd.)

Scope of Project: This project will replace 11.1 miles of domestic/fire, 2.9 miles of laboratory and 4.4 miles of canal water lines. The remaining portions of the existing water lines either serve buildings planned for demolition or will have been rehabilitated with funding currently in the Fire Safety Improvements Line Item.

Alternatives to cast iron pipe were investigated. PVC pipe was chosen for its low cost and high corrosion resistance. The new PVC pipe will withstand the corrosiveness of the soil. Cast iron valves and fittings will be provided with sacrificial anodes for cathodic protection. This project will reduce the frequency of water line breaks due to the deteriorated cast iron pipe. The beneficial results are: a) reliability of fire protection water for property and life safety and b) reliability of laboratory and canal water distribution for Laboratory programs.

10. Details of Cost Estimate*:

	Item Cost	Total Cost
a. Engineering, design, and inspection at 13% of construction costs, item b		$ 530
b. Construction costs		4,180
(1) Site work	0	
(2) Buildings	0	
(3) Utilities	$ 4,180	
Subtotal		$ 4,710
c. Contingency at 10% above costs		490
Total estimated costs		$ 5,200

*Based upon a completed conceptual design and current cost data.

1. Title and location of project: Water line replacement
Argonne National Laboratory (ANL)
Argonne, Illinois

2. Project No.: 87-R-756

11. Method of Performance

Engineering and design will be accomplished by an architect engineer under Laboratory supervision. Construction inspection will be accomplished by Laboratory personnel. Construction will be accomplished via lump-sum, competitively bid construction contract.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1987	FY 1988	FY 1989	Total
a. Total project cost					
1. Total costs					
(a) Construction line item...............	$ 0	$ 400	$ 2,100	$ 2,700	$ 5,200
(b) PE&D................................	0	0	0	0	0
(c) Expense funded equipment............	0	0	0	0	0
(d) Inventories.........................	0	0	0	0	0
Total direct costs..................	$ 0	$ 400	$ 2,100	$ 2,700	$ 5,200
2. Other project costs					
(a) R&D necessary to complete construction......................	$ 0	$ 0	$ 0	$ 0	$ 0
(b) Other project related costs..........	8	0	0	0	8
Total other project costs...........	$ 8	$ 0	$ 0	$ 0	$ 8
Total project costs (Item 1 and 2)...	$ 8	$ 400	$ 2,100	$ 2,700	$ 5,208

b. Other related funding requirements	
1. Facility operating costs..	0
2. Activity operating expenses directly related to the facility..............................	0
3. Capital equipment not related to construction but related to the programmatic effort in the facility..	0
4. GPP or other construction related to programmatic effort in the facility.....................	0
5. Other costs..	0
Total related annual costs..	0

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Water line replacement
   Argonne National Laboratory (ANL)
   Argonne, Illinois

2. Project No.: 87-R-756

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding
   1. Total facility costs
      (a) Construction line item - No narrative required
      (b) PE&D - None
      (c) Expense funded equipment - None
      (d) Inventories - None
   2. Other project funding
      (a) No R & D effort is required
      (b) $8,000 for conceptual design

b. Total related funding requirements

The water lines will have a useful lifetime longer than 30 years.

1. Facility operating costs - Implementation of this project will replace existing water lines. This will result in a reduction of maintenance to repair pipe breaks, and restore an acceptable level of operational efficiency to existing facilities. Thus the facility operating cost is reported as zero.

2. Operating expenses directly related to the facility - Programmatic although this project will restore and replace general purpose facilities employed to perform a wide variety of activities, there is no activity operating expense directly related to, or required for support of this project, thus the activity operating expense is reported as zero.

3. Capital equipment not related to construction but related to the activity effort in the facility - None

4. GPP or other construction related to activity effort - None

5. Other costs - None

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MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES PROGRAM
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Electrical system rehabilitation
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-757

3. Date A-E work initiated: 2nd Qtr. FY 1987

3a. Date physical construction starts: 3rd Qtr. FY 1988

4. Date construction ends: 4th Qtr. FY 1989

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $ 2,600
Less amount for PE&D: 0
Net cost estimate: $ 2,600
Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1987	$ 2,600	$ 300	$ 300	$ 140
1988	0	2,300	2,300	1,780
1989	0	0	0	680

8. Brief Physical Description of Project

This project is the first of several elements to improve the reliability of the electrical distribution system for the entire Laboratory.

This project will rehabilitate the 12kV main substation of Lawrence Berkeley Laboratory's (LBL) power distribution system. LBL's main substation is located on the upper hill area and distributes 28 Megawatts peak power to area substations through a 12.46 kV primary distribution system. The main substation is served by Pacific Gas and Electric (PG&E) through two 115kV/12.46kV transformers with 20 MVA and 30 MVA capacity. The main substation switchgear is arranged in split bus configuration, each bus connecting directly to PG&E switches. Each bus consists of three feeder breakers. A metal enclosed tie switch provides for connection of the two bus systems. The rehabilitation of the main substation will include the replacement of the existing substandard circuit breakers and addition of incoming, tie and feeder circuit breakers. The project provides also for addition of an air switch assembly consisting of feeder and tie switches. The project will utilize the existing substation site with the following structural modifications:

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Electrical system rehabilitation
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-757

8. Brief Physical Description of Project (cont'd.)

- Increase of substation floor space by 600 square feet.
- Extension of existing underground cable vault by 11 feet.
- Construction of retaining walls, up-ramp and stairs for elevated floor section.

The following major items comprise the scope of this project:

1. Replace six existing air circuit breakers with power vacuum circuit breakers.
2. Add three incoming line breakers to the 12kV buses.
3. Replace one existing tie switch between Bus 1 and 2 with a full capacity circuit breaker.
4. Add four feeder breakers to Bus 1 and 3 feeder breakers to Bus 2.
5. Add air switch assembly consisting of 6 feeders and one tie load interrupter switch.
6. Install data acquisition system and communications unit for remote control indication and metering.
7. Perform a power system study determining short circuit levels and protective device coordination.

These new government-owned facilities or improvements will be located on leased land owned by the Regents of the University of California.

1. Title and location of project: Electrical system rehabilitation
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-757

9. Purpose, Justification of Need for, and Scope of Project

This project will correct existing deficiencies at the 12kV main substation, which feeds the area substations of the entire Laboratory. The project will upgrade the substation to current National Electrical Code (NEC) safety requirements and provide for improvement in reliability and maintainability. The project will permit LBL to take advantage of favorable electric rate schedules by providing access to reduced cost interruptible power or higher cost firm power to all Laboratory facilities. The project will fully provide for present and long range power distribution requirements at LBL's main substation.

The existing 12kV main substation does not meet the Laboratory's operating requirements for the following reasons:

1. The existing substation equipment is aged, substandard, and hazardous;

2. The existing bus configuration does not permit LBL to isolate utility incoming lines and bus sections without cooperation from the utility and prior operation of their switchgear.

3. The tie switch in the switchgear assembly is underrated and unsafe to operate without cooperation from the utility company and prior operation of their switches.

4. The existing switchgear has insufficient circuit breakers requiring doubling of outgoing feeders and direct connection of outgoing feeders to the main bus.

5. The minimum space requirements stipulated by the National Electric Code for safe operation and maintenance are not complied with.

The above deficiencies have resulted in the following operational difficulties:

o Incoming line power failure on one supply line requires public utility switching prior to LBL's closing tie switch and restoring service. This results in extensive response time and long power outages.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Electrical system rehabilitation
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-757

9. Purpose, Justification of Need for, and Scope of Project (cont'd)

- Maintenance on switchgear is only performed when power outage occurs. The switchgear construction is such that safe maintenance can only be performed with line and load side de-energized. The line sides can only be de-energized by public utility switching, which occurs at infrequent intervals.

- Utilization of cost economic power source is not always possible. The existing number of feeder breakers is insufficient to provide dual sources to all users for most economic power rate selection.

- Decreased reliability in dual connected supply feeders due to circuit breaker tripping caused by failure in one feeder line and affecting service in the other line.

10. Details of Cost Estimate*:

	Item Cost	Total Cost
a. Engineering, design, and inspection at about 15% of construction costs, item b.		$ 280
b. Construction costs		1,850
(1) Improvements to land	$ 130	
(2) Utilities	240	
(3) Special facilities engineered equipment	$ 1,480	
Subtotal		$ 2,130
c. Contingency at about 22% above costs		470
Total estimated costs		$ 2,600

*Based upon a completed conceptual design.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Electrical system rehabilitation
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-757

11. Method of Performance

Engineering design will be performed under a negotiated architect engineer subcontract. Inspection and some engineering will be done by LBL personnel. Construction and procurement will be accomplished by fixed price subcontracts awarded on the basis of competitive bids. At the time of scoping construction and procurement, specific parts of the project will be set aside for SBA 8A subcontracts. Candidate items are conduit placement, structural slab, cable splicing, fencing and landscaping.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

Not required.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

Not required.

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(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Rehabilitate Mechanical Utilities
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-758

3. Date A-E work initiated: 2nd Qtr. FY 1987

3a. Date physical construction starts: 3rd Qtr. FY 1988

4. Date construction ends: 4th Qtr. FY 1990

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $ 5,500
Less amount for PE&D: 0
Net cost estimate: $ 5,500
Date: January 1986

7. Financial Schedule:

Fiscal Year	Authorization	Appropriations	Obligations	Costs
1987	$ 5,500	$ 1,050	$ 1,050	$ 260
1988	0	3,000	3,000	1,100
1989	0	1,450	1,450	2,580
1990	0	0	0	1,560

8. Brief Physical Description of Project

Lawrence Berkeley Laboratory (LBL) was established over 40 years ago. Portions of the LBL utility systems have deteriorated to the point where maintenance costs have become excessive and service interruptions have become frequent. Most utility systems at LBL were constructed to meet the requirements of specific buildings and experimental programs.

1. Title and location of project: Rehabilitate Mechanical Utilities
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-758

8. Brief Physical Description of Project (cont'd.)

The work proposed under this project will upgrade sections of systems that have been identified as having the most serious deficiencies.

Some examples of the mechanical utilities deficiencies to be addressed are:

1. The 4-inch domestic water main to Building 74 is badly damaged, and failure will jeopardize programs that utilize the animal colony. Piping cross connections have been made with the industrial water supply in violation of the Plumbing Code, and the 8-inch domestic water main form Shasta Reservoir is overstressed due to soil settlement - failure will greatly reduce flow to many Laboratory buildings.

2. The cooling tower at Building 88 is overloaded on hot days, and requires increased cooling capacity.

3. The central compressed air plant is not sufficiently reliable, and interruptions affect various program labwide that rely upon the central air supply.

4. Natural gas mains have exceeded expected life and leaks would result in fire and loss of life, hazards and interruptions to programs.

Proposed facilities will be designed to the latest codes and will use the most suitable types of materials and equipment. The design will provide for more reliable service, safer and more efficient operation, better access and backup capacity for critical features such as fire protection. New work will avoid wherever possible unstable areas on the site and will incorporate the best design and construction practices to mitigate unfavorable site conditions when these areas cannot be bypassed. Timely construction of the proposed work will prevent future breakdowns that could be hazardous, that could disrupt vital LBL functions, and that could result in costly repairs to the old systems.

The improvements described herein will be made to existing government-owned facilities located on leased land owned by the Regents of the University of California.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Rehabilitate Mechanical Utilities
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-758

9. Purpose, Justification of Need for, and Scope of Project

The work proposed under this project is the upgrading and/or replacement of components of existing utility systems throughout the Lawrence Berkeley Laboratory site; this project will not completely rehabilitate the systems, but it will correct the more urgent and serious deficiencies. Much of the piping and equipment that comprise these systems has been in place for many years. Portions of the utilities have outlived their useful life, as evidenced by the repairs and piecemeal replacement that have been necessary to keep the systems in operation. Other portions of the systems, have become obsolete because of changing requirements. Still other sections of utilities have been constructed in areas of the site in which unstable or otherwise unfavorable soil conditions exist; the earlier systems constructed in these areas did not utilized materials and construction methods that are now available to offset the adverse natural conditions. Furthermore, safety standards, quality of materials, and construction techniques have changed over the years so that some of the facilities constructed in the 1940s, the 1950s, and even the 1960s are now substandard. In short, the age, the changing requirements for services, natural site conditions, and higher standards for safety and construction all have contributed to the deficiencies in the existing utility systems.

The rehabilitation of LBL site mechanical utilities has been planned to be phased in two separate projects scheduled for funding in FY 1987, Phase I, and in FY 1990, Phase II. The plan for phasing results from the need to mitigate program disruptions through careful sequencing of construction, to enhance the cost effectiveness of the work by improving the flexibility for change in the first phase, and, finally, to prioritize LBL's funding in relation to other urgent needs.

10. Details of Cost Estimate[a]:

	Total Cost
a. Engineering, design, and inspection at about 15% of construction costs..............	$ 600
b. Construction costs..	3,900
Subtotal..	$ 4,500
c. Contingency at about 22% above costs..	1,000
Total estimated costs..	$ 5,500

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[a] Based on completed conceptual design.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Rehabilitate Mechanical Utilities
Lawrence Berkeley Laboratory
Berkeley, California

2. Project No.: 87-R-758

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11. Method of Performance

Engineering design will be performed under a negotiated architect engineer subcontract. Inspection, some engineering and some construction will be accomplished by LBL engineering staff. Construction and procurement will be accomplished by fixed price subcontracts awarded on the basis of competitive bids. At the time of scoping construction and procurement, specific parts of the project will be set aside for Small Business Administration 8A subcontracts. Candidate items are painting and labeling air and propane equipment and piping associated with upgrading the compressor plant and the propane plant.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1987	FY 1988	FY 1989	FY 1990	Total
a. Total project costs						
1. Total facility costs						
(a) Construction line item.......	$ 0	$ 260	$ 1,100	$ 2,580	$ 1,560	$ 5,500
(b) CP&D.........................	0	0	0	0	0	0
(c) Expense funded equipment.....	0	0	0	0	0	0
(d) Inventories..................	0	0	0	0	0	0
Total direct costs...........	$ 0	$ 260	$ 1,100	$ 2,580	$ 1,560	$ 5,500
2. Other project costs						
(a) R&D necessary to complete construction...............	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
(b) Other project related costs..	0	0	0	0	0	0
Total other project costs....	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
Total project costs (Items 1 & 2)..............	$ 0	$ 260	$ 1,100	$ 2,580	$ 1,560	$ 5,500

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project:	Rehabilitate Mechanical Utilities Lawrence Berkeley Laboratory Berkeley, California	2. Project No.: 87-R-758

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b. Total related annual costs (50 years)

1. Facility operating costs	$ 0
2. Programmatic operating expenses directly related to the facility	0
3. Capital equipment not related to construction but related to the programmatic effort in the facility	0
4. GPP or other construction related to programmatic effort in the facility	0
5. Other costs	0
Total other related annual funding costs	$ 0

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding

1. Total facility costs

(a) Construction line item - No narrative required
(b) CP&D - No narrative required
(c) Expense funded equipment - No narrative required
(d) Inventories - No narrative required

b. Total related funding requirements (Facility Program use est. 50 years).

1. Facility operating costs - No narrative required
2. Programmatic operating expenses - No narrative required
3. Capital equipment no related to construction - No narrative required
4. GPP or other construction - No narrative required
5. Other costs - No narrative required

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CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABORATORIES - GENERAL PURPOSE FACILITIES PROGRAM
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Upgraded steam distribution system
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-759

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3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 1st Qtr. FY 1988

4. Date construction ends: 4th Qtr. FY 1990

5. Previous cost estimate: None
Date: None

6. Current cost estimate: $6,800
Date: January 1986

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7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1987	$ 6,800	$ 2,000	$ 2,000	$ 1,700
1988	0	4,800	4,800	2,600
1989	0	0	0	1,900
1990	0	0	0	600

8. Brief Physical Description of Project

This project will replace deteriorated portions of the Oak Ridge National Laboratory (ORNL) steam distribution system, predominantly in the eastern portion of ORNL, provide looping and isolation valves to improve system reliability and maintainability, and provide condensate return lines as appropriate. Concurrently, deteriorated air lines paralleling the stream distribution system will be replaced.

9. Purpose, Justification of Need for, and Scope of Project

The ORNL steam distribution was originally built in the early 1940's and was modified and expanded through the years. Much of the underground piping has been in service for more than 30 years and is approaching the end of its expected life.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Upgraded steam distribution system
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-759

9. Purpose, Justification of Need for, and Scope of Project (continued)

Recent failures in the steel conduit and bellows expansion joints have resulted in major emergency repairs. A $400,000 emergency General Plant Project (GPP) was completed in FY 1984 to repair a deteriorated bellows expansion joint and replace steam and parallel air lines. In addition to the energy loss, this expansion joint failure was a safety hazard to personnel in the vicinity. Because of these failures and anticipated future failures, a major portion of the buried steam system can no longer be considered reliable. These conclusions are based on an evaluation report by Energy Systems Engineering and further verified by measurements conducted in an Energy Division investigation.

Another $250,000 GPP was also completed in FY 1984 replacing sections of the underground mains to the 7,000 area with above ground lines. The previous underground line was in contact with groundwater and was experiencing excessive heat loss.

As the steam distribution system is presently configured, a single component failure such as a valve, distribution pipe, or expansion bellows, could result in a total system shutdown. Such a shutdown would impact millions of dollars worth of ongoing research experiments and related activities. Heavily used research facilities such as the Oak Ridge Electron Linear Accelerator and the Holifield Heavy Ion Research Facility would be shut down within 24 hours of loss of steam; while a program such as the Space Nuclear Project is susceptible to loss of up to 10 years of test data on long-term creep tests conducted in the High-Temperature Gas Cooled Reactor.

The upgraded system, in addition to improving reliability will allow most services to be continued in the event of line failure by providing steam through alternate routes provided by the added loops and isolation valves. The condensate return system will reduce the treated water and steam load output from the steam plant and hence operating costs.

1. Title and location of project: Upgraded steam distribution system
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-759

9. Purpose, Justification of Need for, and Scope of Project (continued)

In the aforementioned FY 1984 GPP, it was found that the air lines were deteriorated and rapidly approaching the end of their useful life; hence, concurrent with replacement of the steam lines, all deteriorated air lines will be replaced and provided with cathodic protection.

Alternatives to the proposed project are presented in a feasibility study dated February 1, 1984, prepared by an Architect-Engineer (A-E). The report included: (1) upgraded steam system; (2) low-temperature hot water system; and (3) high-temperature hot water system.

The first alternative - low-temperature hot water system - although offering operating savings through lowered energy consumption and maintenance costs, cannot economically support the significantly higher capital costs of installation including the necessary conversion of building heating systems from steam to hot water.

The second alternative - high-temperature hot water system - was quickly determined to be less cost-effective than the low-temperature hot water system as a result of even higher capital costs due to more expensive piping mandated by the use of higher pressures. Further, this option does not offer all of the advantages of the low-temperature system.

10. Details of Cost Estimate*

	Total Cost
a. Engineering, design, and inspection at approximately 18% of construction costs, item b	$ 908
b. Construction costs	4,997
Subtotal	5,905
c. Contingency at approximately 15% of above costs	895
Total estimated costs	$ 6,800

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*The cost estimate is based on a conceptual design report, completed in March 1984 at a cost of $130,000 and revised in February 1985.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Upgraded steam distribution system
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-759

---

11. Method of Performance

Design and inspection will be performed under a negotiated architect-engineer contract. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1987	FY 1988	FY 1989	FY 1990	Total
a. Total project costs						
1. Total facility costs						
(a) Construction line item...............	$ 0	$ 1,700	$ 2,600	$ 1,900	$ 600	$ 6,800
(b) PE&D................................	0	0	0	0	0	0
(c) Expense funded equipment............	0	0	0	0	0	0
(d) Inventories.........................	0	0	0	0	0	0
Total direct costs..................	$ 0	$ 1,700	$ 2,600	$ 1,900	$ 600	$ 6,800
2. Other project costs						
(a) R&D necessary to complete construction......................	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
(b) Other project-related costs..........	130	0	0	0	0	130
Total other project costs...........	$ 130	$ 0	$ 0	$ 0	$ 0	$ 130
Total project costs (Items 1 and 2)..	$ 130	$ 1,700	$ 2,600	$ 1,900	$ 600	$ 6,930

b. Total related annual costs (estimated life: 20 years)

1. Facility operating costs..	$544
2. Programmatic operating expenses directly related to the facility..	0
3. Capital equipment not related to construction but related to the programmatic effort in the facility..	0
4. GPP or other construction related to the programmatic effort in the facility..........................	0
5. Other costs..	0
Total related annual costs..	$544

1. Title and location of project: Upgraded steam distribution system
Oak Ridge National Laboratory,
Oak Ridge, Tennessee

2. Project No.: 87-R-759

---

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements

a. Total project funding
  1. Total facility costs
    (a) Construction line item - No narrative required
    (b) PE&D - No narrative required
    (c) Expense funded equipment - No narrative required
    (d) Inventories - No narrative required
  2. Other project funding
    (a) R&D necessary to complete construction - No narrative required
    (b) Conceptual design costs - The conceptual design report was completed in March 1984 at a cost of approximately $130,000.

b. Total related funding requirement - The estimated useful life of the Upgraded Steam System is 20 years.
  1. Facility operating costs

  These are the estimated costs pertaining to the east end distribution system and building piping systems. They include the energy losses of the distribution, building and condensate return systems due to conduction, trap loss, pit flooding and leakage. They also include maintenance costs for all the piping as well as the pumping costs of the condensate return.
  2. Programmatic operating expenses directly related to the facility - No narrative required
  3. Capital equipment not related to construction but related to the programmatic effort in the facility - No narrative required
  4. GPP or other construction related to the programmatic effort in the facility - No narrative required

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
ENVIRONMENTAL COMPLIANCE UPGRADE

(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: Non-radiological process waste
   treatment project
   Oak Ridge National Laboratory
   Oak Ridge, Tennessee

2. Project No.: 86-R-801

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3. Date A-E work initiated: 1st Qtr. FY 1986

3a. Date physical construction starts: 3rd Qtr. FY 1987

4. Date construction ends: 4th Qtr. FY 1989

5. Previous cost estimate: 3,000*
   Date: December 1984

6. Current cost estimate: $18,000
   Less FY 1984 PE&D: 0
   Net cost estimate $18,000
   Date: September 1985

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7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1986	$ 3,000	$ 2,887	$ 2,887	$ 1,587
1987	15,000	7,000	7,000	5,000
1988	0	8,113	8,113	7,113
1989	0	0	0	4,300

8. Brief Physical Description of Project

A Non-Radiological Wastewater Treatment Project (NRWTP) is proposed for the Oak Ridge National Laboratory (ORNL) that will address regulatory environmental compliance concerns. Among these concerns are certain non-radiological process waste streams which are currently discharged untreated into area creeks and the active use of surface impoundments for process wastewater. This project proposes to modify process systems (eliminate nitric acid regeneration of demineralizers) and to collect and treat these streams as required to meet discharge parameters as established by the Environmental Protection Agency (EPA) and the State of Tennessee and to eliminate the discharge of hazardous wastewater into surface impoundments. The NRWTP will provide required collection, treatment, and monitoring facilities based on wastewater characterization and treatability studies to meet effluent criteria established by regulatory agencies.

*Previous cost estimate of $3,000,000 provided for Title I and II engineering design FY 1986.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Non-radiological process
waste treatment project
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 86-R-801

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8. Brief Physical Description of Project (continued)

Physical construction will include pumps, tanks, and piping to transfer wastewater to treatment facilities, tankage to replace surface impoundments process modification (replacement of nitric acid demineralizer regeneration systems) to reduce pollutant loading, special equipment to accomplish the desired handling and treatment of wastewater and resultant solid waste, computerized monitoring and control equipment, and new buildings to house equipment and support facilities.

9. Purpose, Justification of Need for, and Scope of Project

The purposes of this project are to resolve the major Clean Water Act concerns at ORNL with respect to the discharge of nonradiological process wastewater and to eliminate the discharge of hazardous wastewater into surface impoundments by November 8, 1988, in compliance with provisions of the reauthorized Resource Conservation and Recovery Act (RCRA). Current liquid effluents are not in compliance with the Clean Water Act and the Tennessee Water Quality Act. The National Pollutant Discharge Elimination System (NPDES) permit issued by the EPA and state will identify new monitoring and effluent points and discharge limits. The permit will require that all process wastewater be treated. This project will provide treatment which will ensure ORNL's compliance with discharge parameters. The project will also provide tankage to eliminate the discharge of process wastewater into surface impoundments. Cleanup of these impoundments will be provided under other projects.

The proposed project will treat the effluent streams from ORNL facilities including the Process Waste Treatment Plant (Building 3544), Central Research and Administration (4500 Area), Environmental Sciences Laboratory (Building 1505), Radioisotope Production Laboratories (3000 Area, non-radiological effluents), various flows from Melton Valley (High-Flux Isotope Reactor and the Transuranium Processing Plant, non-radiological effluents), and other waste streams.

Considered a major stream, the effluent from Building 3544, is currently being treated by ion exchange to remove only radioactivity but has exceeded NPDES limits in several parameters (dissolved solids, chemical oxygen demand (COD), and nitrates). Other streams are not currently treated and surpass the NPDES requirements and must be treated. The current waste treatment plant (Building 3544), even with modifications, does not have the capability to treat all exceeded parameters, and is designed for a lower feed rate than will be required to treat the combined feed streams. Therefore, it is necessary to build a new wastewater treatment system with the capability to treat these streams.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Non-radiological process waste treatment project
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 86-R-801

10. Details of Cost Estimate	Item Cost	Total Cost
a. Engineering, design, and inspection at approximately 24%* of construction costs, item b		$ 2,700
b. Construction costs		11,280
(1) Land improvements	$ 250	
(2) New buildings	605	
(3) Special facilities	9,420	
(4) Outside utilities	1,005	
Subtotal		13,980
c. Contingency at approximately 29% of above costs		4,020
Total estimated cost		$ 18,000

*This estimate is from the Conceptual Design Report completed in May 1985.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Non-radiological process waste treatment project
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 86-R-801

11. Method of Performance

Design and inspection will be performed under negotiated architect-engineer contract and by the operating contractor. To the extent feasible, construction and procurement will be accomplished by fixed-price prime contracts awarded on the basis of competitive bids.

12. Funding Schedule of Project Funding and Other Related Funding Requirements

	Prior Years	FY 1987	FY 1988	FY 1989	Total
a. Total project costs					
1. Total facility costs					
(a) Construction line item	$ 1,587	$ 5,000	$ 7,113	$ 4,300	$18,000
(b) PE&D	0	0	0	0	0
(c) Expense funded equipment	0	0	0	0	0
(d) Inventories	0	0	0	0	0
Total facility costs	$ 1,587	$ 5,000	$ 7,113	$ 4,300	$18,000
2. Other project costs					
(a) R&D necessary to complete construction	$ 0	$ 0	$ 0	$ 0	$ 0
(b) Conceptual design costs	350	0	0	0	350
Total other project costs	$ 350	$ 0	$ 0	$ 0	$ 350
Total project costs	$ 1,937	$ 5,000	$ 7,113	$ 4,300	$18,350*

*This total includes $350,000 for a Conceptual Design completed in May 1985.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Non-radiological process
waste treatment project
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 86-R-801

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12. Funding Schedule of Project Funding and Other Related Funding Requirement (continued)

b. Total related annual costs (estimated life: 20 years)

1. Facility operating costs	$ 1,600
2. Programmatic operating expenses not directly related to the facility	0
3. Capital equipment not related to construction but related to the programmatic effort in the facility	0
4. GPP or other construction related to the programmatic effort in the facility	0
5. Other costs	600*
Total related annual costs	$ 2,200**

*This cost is a one-time cost in FY 1985.
**These costs are expressed in FY 1984 dollars and do not include overhead.

13. Narrative Explanation of Funding Schedule

a. Total project funding

1. Total facility costs

(a) Construction line item

No narrative required.

(b) PE&D

No narrative required.

(c) Expense funded requirement

No narrative required.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and location of project: Non-radiological process
waste treatment project
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 86-R-801

13. Narrative Explanation of Funding Schedule (continued)

(d) Inventories

No narrative required.

2. Other project funding

(a) R&D necessary to complete construction

No narrative required.

(b) Conceptual design costs

Approximately $350,000 will be spent in FY 1985 to provide a Conceptual Design.

b. Total related funding requirement

The useful life of the NRWTP is 20 years.

1. Facility operating costs

These estimated costs include chemicals and supplies, labor costs, utilities, and waste disposal.

2. Programmatic operating expenses not directly related to the facility

No narrative required.

3. Capital equipment not related to construction but related to the programmatic effort in the facility

No narrative required.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: Non-radiological process
waste treatment project
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 86-R-801

---

13. Narrative Explanation of Funding Schedule (continued)

4. GPP or other construction related to the programmatic effort in the facility

No narrative required.

5. Other costs

This estimated cost is to conduct waste stream characterization, treatability studies, effluent definition, and other support activities necessary prior to Title I and II design of this project.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
MULTIPROGRAM ENERGY LABORATORIES-FACILITIES SUPPORT
ENVIRONMENTAL COMPLIANCE UPGRADE
(Tabular dollars in thousands. Narrative material in whole dollars.)

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1. Title and location of project: General plant projects
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 87-R-770

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3. Date A-E work initiated: 1st Qtr. FY 1987

3a. Date physical construction starts: 2nd Qtr. FY 1987

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: None
Date:

6. Current cost estimate: $3,000
Less FY 1985 PE&D: 0
Net cost estimate $3,000
Date: January 1985

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7. Financial Schedule:

Fiscal Year	Obligations	Costs FY 1985	FY 1986	FY 1987	After FY 1987
1987	3,000	0	0	1,500	1,500

8. Brief Physical Description of Project

These projects provide for the many miscellaneous alterations, additions, modifications, replacements, and non-major new construction items required to reduce or eliminate environmentally harmful discharges from ORNL.

o Upgrade Process Waste Collection System, 2000 area .... $ 800

This project will provide modifications to the Process Waste Collection System in the 2000 area of ORNL. Preliminary investigations indicate that inappropriate cross-connections between the various collection systems exist which allow process effluents to be discharged to White Oak untreated. This project will correct these inappropriate connections and provide miscellaneous upgrading of system integrity.

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1. Title and location of project: General plant projects
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 87-R-770

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8. Brief Physical Description of Project (continued)

o Groundwater Monitoring Network, Phase III .... $ 350

This project is Phase III of an overall groundwater monitoring network being installed at ORNL and surrounding areas to determine to what extent the groundwater is contaminated. This network consists of a large number of groundwater wells strategically located around specific impoundments, pits, disposal areas, etc.

o Hydrostatic Head Measuring Stations, Bethel Valley 950

This project consists of the construction of several Hydrostatic Head Measuring Stations at preselected locations in the Bethel Valley area. Each station will consist of a cluster of three separate wells, one drilled to a depth of about 80 feet below grade, a second drilled to a depth of 200 feet below grade, and a third drilled to a depth of 400 feet below grade.

o Wastewater Piping Replacement, 4500 Area 900

This project will provide modifications and upgrading to the Process Waste Collection System in the ORNL 4500 Area. Preliminary investigations indicate that inappropriate cross-connections between the various collection systems exist which allow process effluents to be discharged to White Oak Creek untreated. This project will correct these deficiencies and provide other miscellaneous upgrading of system integrity.

9. Purpose, Justification of Need for, and Scope of Project

o Upgrade Process Waste Collection System, 2000 Area

Inappropriate connections of process drains to the storm sewer or sanitary sewer introduce Category III effluents to these systems. These effluents are discharged to area streams and exceed ORNL's national Pollutant Discharge Elimination System (NPDES) permit limits. This project is necessary to meet permit compliance requirements.

CONSTRUCTION PROJECT DATA SHEETS

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1. Title and location of project: General plant projects
Oak Ridge National Laboratory
Oak Ridge, Tennessee

2. Project No.: 87-R-770

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9. Purpose, Justification of Need for, and Scope of Project (continued)

o Groundwater Monitoring Network, Phase III

Various ponds, impoundments, and other disposal/storage areas around the ORNL site have been determined to be RCRA sites. To meet the RCRA regulations, a groundwater monitoring system must be installed around each of these sites. The monitoring network is needed to determine if groundwater contamination is occurring and to determine containment of RCRA regulated waste.

o Hydrostatic Head Measuring Stations, Bethel Valley

The hydrostatic head measuring stations will provide the capability to define and model groundwater flow in the ORNL area. It is necessary to develop an accurate description of large-scale groundwater flow in the Bethel Valley area to support alternative evaluations for cleanup actions under both RCRA and CERCLA.

o Wastewater Piping Replacement, 4500 Area

Inappropriate connections of process drains to the storm sewer or sanitary sewer introduce Category III effluents to these systems. These effluents are discharged to area streams and exceed ORNL's National Pollutant Discharge Elimination System (NPDES) permit limits. This project is necessary to meet permit compliance requirements.

10. Details of Cost Estimate

The estimated costs are preliminary and in general indicate the magnitude of each program. These costs included engineering, design, construction, and inspection.

11. Method of Performance

Design will be on the basis of negotiated architect-engineer contracts. To the extent feasible, construction and procurement will be accomplished by firm fixed-price contracts and subcontracts awarded on the basis of competitive bidding.

Supporting Services

DEPARTMENT OF ENERGY
FISCAL YEAR 1987 CONGRESSIONAL BUDGET REQUEST
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
SUPPORTING SERVICES

VOLUME 3

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DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
PROGRAM OVERVIEW

IN-HOUSE ENERGY MANAGEMENT

The goal of the In-house Energy Management Program is to reduce energy consumption and utility/energy costs for the Department's facilities. As such, the program supports all mission areas. The program is structured to survey and study facilities and processes owned by the Department in order to identify retrofits and modifications to Departmental facilities which save energy and have a high return on investment. Projects identified are competed on a DOE-wide basis and selected to maximize the Department's economic return.

Recent significant accomplishments include:

- $1,895,000 was invested in FY 1986 for surveys and studies to identify retrofit projects for future funding and to identify no or low cost operational changes to reduce current energy consumption.
- Twenty-six projects were funded in FY 1986 which, when complete, will have a payback of 1.6 years.
- FY 1985 energy consumption per square foot in DOE buildings has been reduced by 16.1 percent as compared to FY 1975.
- FY 1985 petroleum consumption in DOE buildings has been reduced by 52 percent as compared to FY 1975.

Specific objectives for FY 1987:

- To reduce energy consumption per square foot in DOE buildings by one percent each year.
- To identify and fund additional retrofit projects with a high rate of return on investment as required by the National Energy Conservation Policy Act, Public Law 95-619, in order to improve the energy efficiency and reduce operating costs of the Department of Energy. Continuation of an annual program of quick payback retrofit projects for the Department's facilities reduces outyear utility costs, provides a rate of return exceeding 35 percent on the dollars invested and will meet goals set by legislation and executive order.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
IN-HOUSE ENERGY MANAGEMENT
ENERGY SUPPLY RESEARCH AND DEVELOPMENT - OPERATING EXPENSES
ENERGY SUPPLY RESEARCH AND DEVELOPMENT - PLANT AND CAPITAL EQUIPMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Adjusted Appropriation	FY1987 Base	FY1987 Request	Request vs Base
Operating Expenses					
Surveys and Studies-------	$2,000	$1,895	$1,895	$1,500	$-395
Construction					
Modifications for Energy Management, Various Locations-----------------	10,000	4,811	4,811	9,003	+4,192
Cogeneration Facility, Brookhaven National Laboratory----------------	1,600	4,811	0	0	0
Solid Waste Fired Boiler Facility, Los Alamos National Laboratory--------	0	1,732	1,732	5,868	+4,136
Advanced Test Reactor Waste Heat Recovery, Idaho National Laboratory-------	0	0	0	0	0
Fuel Storage Facility, Brookhaven National Laboratory----------------	1,000	1,443	1,443	57	-1,386
Combustion Air Preheater, Energy Technology Engineering Center--------	1,400	1,828	1,828	72	-1,756
Energy Monitoring and Control System, Mound Facility-----------------	0	0	0	0	0
General Reduction----------		-4,811			
Subtotal					
Operating Expenses--------	2,000	1,895	1,895	1,500	-395
Construction--------------	14,000	9,814	9,814	15,000	+5,186
In-house Energy Management--------------	$16,000	$11,709 1/	$11,709 1/	$16,500	$+4,791
Less use of prior year deobligations-------	- 1,179				
Total In-house Energy Management---------------	$14,821	$11,709	$11,709	$16,500	$+4,791

1/ This amount excludes $2,791,000 proposed to be reprogrammed to the Office of Scientific and Technical Information.

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer.	General Reduction	FTE General Reduction	Gramm-Rudman-Hollings Reduction	Subtotal	Comparability Adjustments	Adj. Approp. Total
In-house Energy Management							
Survey and Studies Operating Expenses	$ 2,000	$ -24	$ -6	$ -75	$1,895	--	$ 1,895
Modifications for Energy Management, Various Locations Construction	5,000	--	--	-189	4,811	--	4,811
Fuel Storage Facility, Brookhaven National Laboratory Construction	1,500	--	--	-57	1,443	--	1,443
Cogeneration Facility, Brookhaven National Laboratory Construction	5,300	--	--	-200	5,100	-289	4,811
Combustion Air Preheater, Energy Technology Engineering Center ... Construction	1,900	--	--	-72	1,828	--	1,828
Solid Waste Fired Boiler Facility, Los Alamos National Laboratory Construction	1,800	--	--	-68	1,732	--	1,732
Energy Monitoring and Control System, Mound Facility Construction	1,700	--	--	-64	1,636	-1,636	--
Waste Heat Recovery, Idaho National Laboratory Construction	900	--	--	-34	866	-866	--
Subtotal, In-House Energy Mgmt.	20,100	-24	-6	-759	19,311	-2,791	16,520
General Reduction: Capital Equipment	-5,024	24	--	189	-4,811	--	-4,811
FTE Reduction	-6	--	6	--	--	--	--
Total, In-House Energy Mangement	$15,070	$ --	$ --	$ -570	$14,500	$-2,791	$11,709
Operating Expenses	2,000	-24	--	-75	1,895	--	1,895
Capital Equipment	-5,024	+24	--	189	-4,811	--	-4,811
Construction	18,100	--	--	-684	17,416	-2,791	14,625

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
IN-HOUSE ENERGY MANAGEMENT

(In thousands of dollars)

FY 1986 Adjusted Appropriation	$11,709
Built in increases and decreases:	
None	0
1987 Base	$11,709
Program increases and decreases:	
Surveys and Studies Operating Expense	
- Decrease the number of surveys and studies	- 395
Modifications for Energy Management, Various locations	
- Increase the number of small retrofits	+ 4,192
Solid Waste Fired Boiler Facility, Los Alamos National Laboratory	
- Complete the FY 1986 project	+ 4,136
Fuel Storage Facility, Brookhaven National Laboratory	
- Complete the FY 1985 retrofit project	- 1,386
Combustion Air Preheater, Energy Technology Engineering Center	
- Complete the FY 1985 retrofit project	- 1,756
FY 1987 Budget Request	$16,500

In-house Energy Management
Narrative Justification

The FY 1987 budget request for the In-house Energy Management Program is $16,500,000, which is a $4,791,000 increase over the FY 1986 adjusted appropriation. The requested amount reflects a continuing effort to hold down DOE energy costs by funding quick payback energy saving retrofit projects for DOE facilities. Major program objectives are: to retrofit all Department buildings by FY 1990 as required by the National Energy Conservation Policy Act of 1978 (Public Law 95-619), to improve the efficiency of the Department's central heating plants by retrofitting and improving plant operation, and to reduce energy consumption in the Department's facilities by one percent per year. Specific program elements include:

- Surveys of existing buildings and processes to identify cost effective energy conservation retrofits and central heating plant improvements.
- Energy conservation retrofit projects to improve the energy efficiency of process and production systems at various field sites.
- Energy conservation retrofit projects to improve the energy efficiency of DOE buildings.
- Central heating plant improvement projects to increase the efficiency of the Department's central heating plants.

The proposed funding level of $16,500,000 will allow continuation of surveys to identify future years' retrofits and provides continuation of retrofit projects begun in FY 1985 and FY 1986. The projects proposed have an average payback of 2.2 years, a rate of return on investment of over 35 percent, and provide outyears utility savings for all DOE programs.

The following is a summary of the program:

Energy conservation surveys and studies $1,500,000

These operating funds are required to conduct energy conservation surveys of existing buildings and process and production systems in order to identify retrofit projects to reduce energy consumption and utility costs. These funds are used to a much lesser extent to develop model programs for DOE sites, such as the boiler operator training and tuneup program. The energy conservation surveys accomplished under this funding provide the engineering investigations to document energy savings resulting from proposed retrofits, address life-cycle cost effectiveness and provide construction cost estimates for retrofits for future funding.

In-house Energy Management

Modifications for Energy Management, Various Locations	$9,003,000

This line item provides funds for various small energy conservation retrofits costing less than $1,200,000 each. These small energy conservation retrofits are competed DOE wide and prioritized on economic return, thus assuring the greatest return on investment for the Department for the funds invested. The projects selected for funding under this line item have an average payback of 2.1 years.

Solid Waste Fired Boiler Facility, Los Alamos National Laboratory..	$5,868,000

This funding provides for the completion of a project to provide a boiler which fires solid waste and provides steam for the Los Alamos Lab. The project has a total estimated cost of $7.6 million and a payback of 2.5 years.

Fuel Storage Facility, Brookhaven National Laboratory..	$ 57,000

This funding provides for the completion of a project for the installation of three 8,000 barrel fuel storage tanks, clarifiers, and associated piping and pumps for waste liquid fuel feedstocks that are not miscible with No. 6 fuel oil but can be burned in the site's boilers. The project has a total estimated cost of $2.7 million and a payback of 2.6 years.

Combustion Air Preheater, Energy Technology Engineering Center..	$ 72,000

This funding provides for the completion of a project for the installation of a combustion air preheat system to reduce fuel consumption. The project has a total estimated cost of $3.3 million and a payback of 2.4 years.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT - PLANT AND CAPITAL EQUIPMENT
ENERGY APPLICATIONS
IN-HOUSE ENERGY MANAGEMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and Location of Project: Modifications for Energy Management, Various Locations

2. Project No. 87-A-601

3. Date A-E work initiated: 2nd Qtr. FY 1987

3a. Date physical construction starts: 4th Qtr. FY 1987

4. Date construction ends: 1st Qtr. FY 1990

5. Previous cost estimate:
Date: None

6. Current cost estimate: $9,003
Date: June 1985

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1987	$9,003	$9,003	$9,003	$1,800
1988	0	0	0	3,252
1989	0	0	0	3,251
1990	0	0	0	700

8. Brief Physical Description of Project:

This line item is for various small retrofit projects to reduce energy consumption. These small modifications will be selected on the basis of return on investment and energy savings. Projects compete on a DOE-wide basis for funding under this lump sum item, thus assuring the greatest return and greatest energy savings per investment dollar for the Department. The average payback for this line item based on past experience, is about 2.1 years.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and Location of Project: Modifications for Energy Management, Various Locations   2. Project No. 87-A-601

9. Purpose Justification of Need for, and Scope of Project:

Less than 50 of the most economical projects will be funded. The projects range from less than $5,000 to $1,200,000. The projects are for HVAC modifications, insulation of buildings, waste heat recovery, installation of more efficient lighting, steam line modifications, power factor improvements, etc. The quick payback projects selected for this line item will have the following total life-cycle cost effect utilizing a present value analysis:

Average Savings to Investment Ratio (SIR)	7.1
Average Payback Period	2.1
Total Annual Energy Savings	939 billion Btus
Annual Dollar Savings	$3,979,500

10. Details of Cost Estimate:

There are less than 50 projects each with total estimated cost (TEC) less than $1,200,000 which will be funded by this line item. The projects will be selected on the basis of economic return.

11. Method of Performance:

Design and inspection will be performed under negotiated architect-engineer contracts. Construction and procurement will be accomplished by fixed-price contracts awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Requirements:

Not required.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements:

Not required.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT - PLANT AND CAPITAL EQUIPMENT
ENERGY APPLICATIONS
IN-HOUSE ENERGY MANAGEMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and Location of Project: Solid Waste Fired Boiler Facility
Los Alamos National Laboratory,
New Mexico

2. Project No. 86-A-605

3. Date A-E work initiated: 2nd Qtr. FY 1986

3a. Date physical construction starts: 4th Qtr. FY 1986

4. Date construction ends: 4th Qtr. FY 1988

5. Previous cost estimate: None
Date:

6. Current cost estimate: $7,600
Less amount for CP&D 0
Net cost estimate: $7,600
Date: February 1984

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1986	$1,732	$1,732	$1,732	$ 700
1987	5,868	5,868	5,868	6,800
1988				100

8. Brief Physical Description of Project:

The project to be funded is a waste heat recovery facility, fueled by readily available industrial and municipal refuse. This nonhazardous Solid Waste Reduction Facility would be housed in an approximately 16,500 square foot building located on a 2-1/2-acre fenced site at S-Site (TA-16). Adjacent to an exisiting 33 year old central steam plant, this new facility would replace the existing steam plant and provide the heating and process steam for 65 buildings in two technical areas, through an existing piping distribution system.

1. Title and Location of Project: Solid Waste Fired Boiler Facility
Los Alamos National Laboratory,
New Mexico

2. Project No. 86-A-605

8. Brief Physical Description of Project: (Continued)

Road work to be included is removal of approximately 830 linear feet of existing road and construction of approximately 1,500 linear feet of new two-lane site service road, consistent with the Laboratory Long Range Development Plan. Improvements to the main arterial, State Road 4, provide for highway safety to accommodate slow-moving garbage trucks serving the facility and include 400 linear feet of acceleration and deceleration lanes, left-hand turn lane, and 500 linear feet transition zones for a total of 1,400 linear feet of two-lane road widened to four-lane and approximately 4,000 linear feet total two-lane highway widened to three-lane for an adequate passing zone in a mountainous area. Approximately 1,300 linear feet of chain-link industrial security fence is included for the site perimeter.

The facility houses utility process functions including steam generation. The following equipment listed in order of the process is required: garbage truck weigh-in scale; radiation monitoring alarm system; knuckleboom crane, fuel feed system; chemical feed and boiler feedwater system; 45-ton per day controlled air technology incinerators; 12,000-lb. per hour fire-tube waste heat recovery boilers; 300 Boiler Horse Power packaged auxiliary boilers; 30,000 SCFM electrostatic precipitators; ash removal system; ash disposal system, and chilled water equipment.

Two complete 45-ton per day modules as described would be provided to ensure maintenance, reliability, steam production, and refuse disposal, underscored by the projected growth of both steam usage and refuse supply over the facility's 20-year lifetime. All the listed equipment is standard and commercially available with a proven history of operation. It would be installed in a pre-engineered metal building, 30-feet eave height, with a concrete slab unloading floor. This unloading floor inside the facility allows refuse to be deposited from the refuse trucks within the building confines and precludes the problems associated with wind-blown waste. Approximately 3-days storage would be provided inside, although the incinerator design would be based upon daily clearance of refuse.

The 16,500 square foot building interior is essentially open and unpartitioned with grating-type walkways on a mezzanine level to facilitate equipment servicing. The interior rooms will be limited to minimal support areas, including a weight scale office, superintendent's office, boiler operator's control room, locker rooms, rest rooms, maintenance shop, and parts storage for a total of approximately 2,500 square feet. The building will be heated by steam unit heaters and duct furnaces. Adequate mechanical ventilation will be provided. The building will be protected by a wet-pipe automatic sprinkler system.

1. Title and Location of Project: Solid Waste Fired Boiler Facility
Los Alamos National Laboratory,
New Mexico

2. Project No. 86-A-605

8. Brief Physical Description of Project: (Continued)

The project, as proposed, is consistent with the Laboratory Long-Range Plan, Five-Year Implementation Plan, and the Energy Management Plan. Utilities to be provided include natural gas, steam, condensate, electricity, water, and telephone. All existing utilities in the area have been located and the new facility site was chosen to avoid these while still providing for convenient connections.

Standard equipment is a truck to haul dumpster boxes to the stockpile area or sanitary landfill for dumping as they become full of ash. Included is a 5-ton short-bed truck with two dumpster boxes for alteration.

9. Purpose, Justification of Need for, and Scope of Project:

The objectives of this project are:

- To conserve fossil fuels through cost effective alternative fuel displacement.
- To efficiently provide heating and process steam for 65 buildings through incineration of Laboratory and Los Alamos County nonhazardous waste.
- To provide a life-cycle cost effective facility with a short payback period.
- To avoid the siting and construction of any unnecessary new sanitary landfills.
- To implement the Laboratory Long-Range Plan.

The Los Alamos National Laboratory and the County of Los Alamos exist in a unique and closely-bound relationship. Identifiable almost as a "company town," the situation exists where a fuel supplier and an energy user have interconnecting goals. Reduction of waste and reduction of energy use are, in this case, mutually compatible.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and Location of Project: Solid Waste Fired Boiler Facility
Los Alamos National Laboratory,
New Mexico

2. Project No. 86-A-605

9. Purpose, Justification of Need for, and Scope of Project: (Continued)

The County has a waste disposal "problem" and the Laboratory has a fuel usage "need."

The facility proposed will handle the total combustible waste stream currently being landfilled, along with projected volumes through the year 2007. Approximately 80% of the combustible fuel for this facility would be supplied by the Los Alamos County from municipal and commercial refuse collections and would be delivered to the new facility. The 20% supplied by the Laboratory would be transported by the Laboratory maintenance contractor to the new facility.

The community populace will access the new facility indirectly through normal municipal collections and by depositing rubbish at a community transfer station. This station will be serviced by packing-type garbage trucks, which will transfer the waste to the waste reduction plant.

This facility provides a waste volume reduction of 90% to 95%. Thus, any remaining County landfill, which is located on DOE land, gains a 10 to 20 times increase in lifetime from the use of incineration. The residual 5% to 10% ash, a granular cinder-type material, can be used as road base and structural fill as it already is in some states. This would further extend the landfill's useful lifetime.

Recovering the waste heat from the incineration process will provide from 48% to 57% of the steam needs of the 65 existing buildings. This fuel percentage from waste requires the balance to be provided by auxiliary packaged fire-tube boilers. These will be sized to match the existing and projected steam load more closely than does the existing 33-year-old plant being replaced. The existing facility is beyond its expected life, is inefficient, and does not have solid waste alternative fuel capabilities. The existing facility would be rendered inactive to provide an emergency back up ensuring the programmatic weapons related work at the technical areas served would not be interrupted.

The proposed timing of the construction is critical. If the facility is not constructed on time, the existing landfill, with a projected life of 3 years, may fill before the alternative solid waste reduction facility is completed.

1. Title and Location of Project: Solid Waste Fired Boiler Facility
Los Alamos National Laboratory,
New Mexico

2. Project No. 86-A-605

9. Purpose, Justification of Need for, and Scope of Project: (Continued)

Failure to fund this project will result in discarding approximately 2.82 billion Btus of fuel resource into a nonrecoverable landfill, which will further encumber another laboratory resource, land. The existing TA-16 steam plant would be operated at its current level of inefficiency. Its need for replacement can be anticipated in the future because it is already beyond its expected operating lifetime. Its continued use beyond expected lifetime could affect programmatic efforts at TA-16 and Anchor Site East (TA-9) through unreliable steam production, and/or higher maintenance costs.

A life cycle cost analysis, performed in accordance with NBS Handbook 135, revised 9/84, yields the following:

Savings to Investment Ratio	6.4
Payback Period	2.5 years
Annual Energy Savings	250 Billion Btus
Annual Dollar Savings	$2,782,309

10. Details of Cost Estimate:*

a. Engineering, design, and inspection cost**		$670
(1) Facilities at about 15% of construction costs, less Item b.3	$ 340	
(2) Special facilities equipment costs at about 10% of Item b.3	330	
b. Construction costs		
(1) Improvements to land, including intersections, road, and sitework	1,150	

* The above estimate is based on a completed conceptual design and a technical study by an architect engineering firm. The Laboratory is using escalation rates of 3.1% for CY 1984, 6.1% for CY 1985, 7.6% for CY 1986, 6.6% for CY 1987 and 6.9% for CY 1988. These rates were forecasted using Data Resources, Incorporated forecasting services. These services were contracted by the Department of Energy.

** Engineering, design, and inspection costs are projected from historical records and experience, then applied based on the complexity of the project.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and Location of Project:	Solid Waste Fired Boiler Facility Los Alamos National Laboratory, New Mexico	2. Project No. 86-A-605

10. Details of Cost Estimate:* (Continued)

(2) Building - 16,500 square feet @ about $61/square feet	980	
(3) Special facility equipment, including fuel feed, and ash handling systems, incinerators, central steam equipment, radiation monitoring, and pollution control equipment.	3,360	
(4) Utilities, including natural gas, steam, condensate, electricity, water, and telephone.	160	
c. Standard equipment		80
d. Contingency @ approximately 19% of the above costs***		1,200
Total project cost		$7,600

11. Method of Performance:

Design and inspection will be performed under a negotiated architect-engineer contract. Special facility equipment design and procurement will be performed by the operating contractor. Standard equipment procurement will be by the operating contractor. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts and subcontracts awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Funding Requirements:

	Prior Years	FY-1986	FY-1987	FY-1988	Total
a. Total Project Funding					
1. Total facility cost					
(a) Construction line item.....	$ 0	$ 700	$6,800	$ 100	$7,600
(b) PE&D......................	0	0	0	0	0
(c) Expense funded equipment...	0	0	0	0	0
(d) Inventories................	0	0	0		
Total Facility Costs.......	$ 0	$ 700	$6,800	100	$7,600

*** Contingencies are applied to items based on the uncertainties of the development at the conceptual level.

1. Title and Location of Project: Solid Waste Fired Boiler Facility
Los Alamos National Laboratory,
New Mexico

2. Project No. 86-A-605

12. Funding Schedule of Project Funding and Other Related Funding Requirements: (Continued)

	Prior Years	FY-1986	FY-1987	FY-1988	Total
2. Other project costs					
(a) Conceptual design..........	$100	$ 0	$ 0	$ 0	$ 100
(b) Other projected related costs....................	0	0	0	0	0
Total other projected funding..................	100	0	0	0	100
Total project costs (Item 1 & 2).............	$100	$ 700	$6,800	$ 100	$7,700

b. Total related funding requirement (estimated life of project: 20 years)

1. Facility operating costs..	$1,400
2. Programmatic operating expenses directly related to the facility..................	0
3. Capital equipment not related to construction but related to the programmatic effort in the facility..	0
4. GPP or other construction related to programmatic effort in facility...............	0
5. Other costs..	0
Total other related annual funding requirements...	$1,400

13. Narrative Explanation of Total Project Funding and Other Related Requirements

a. Total project funding

(1) Total facility costs. No narrative required.

(2) Other project funding

(a) The amount shown is for conceptual design that is necessary to establish the specific design and construction features.

(b) Other project-related costs. No narrative required.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and Location of Project: Solid Waste Fired Boiler Facility
Los Alamos National Laboratory,
New Mexico

2. Project No. 86-A-605

13. Narrative Explanation of Total Project Funding and Other Related Requirements: (Continued)

b. Total related funding requirements

(1) The annual facility operating costs are estimated to FY 1988, the first full year of operation as follows: Historical costs from similar operating central steam plants, both at the Laboratory and Nationwide, were escalated from FY 1983 by 3.1% for FY 1984, 6.1% for FY 1985, 7.6% for FY 1986, and 6.6% for FY 1987. Fuel costs adjusted for alternative fuel contribution were escalated using the required rates from the Federal Register.

(2) This facility is solely utility related and requires no programmatic-related funding.

(3) Capital equipment requirements unrelated to construction are not anticipated

(4) No GPP or other construction related to programmatic effort are anticipated.

(5) No other costs are anticipated.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT - PLANT AND CAPITAL EQUIPMENT
ENERGY APPLICATIONS
IN-HOUSE ENERGY MANAGEMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and Location of Project: Fuel Storage Facility
Brookhaven National Laboratory,
Upton, N.Y

2. Project No. 85-A-602

3. Date A-E work initiated: 3rd Qtr. FY 1985

3a. Date physical construction starts: 1st Qtr. FY 1986

4. Date construction ends: 2nd Qtr. FY 1987

5. Previous cost estimate:	$2,700
Less amount for PE&D	200
Net cost estimate:	$2,500
Date: September 1982	
6. Current cost estimate:	$2,700
Less amount for PE&D	200
Net cost estimate:	$2,500
Date: October 1984	

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1985	$1,000	$1,000	$1,000	$ 700
1986	1,443	1,443	1,443	1,300
1987	57	57	57	500

8. Brief Physical Description of Project:

This project provides for the installation of three (3) 8,000 barrel fuel storage tanks, clarifiers, transfer pumps, associated piping controls and electrical work. The facility will be used for the storage of inexpensive, low viscosity, light feedstocks that are not miscible with No. 6 fuel oil, and can be directly fired in the existing boilers at the Central Steam Facility.

1. Title and Location of Project: Fuel Storage Facility
Brookhaven National Laboratory
Upton, N.Y.

2. Project No. 85-A-602

8. Brief physical Description of Project: (Continued)

The fuel storage system and equipment configuration will remove any noncombustibles (e.g., water, sediments, etc.) before the fuel is transferred into the existing fuel oil storage and piping system. The new equipment will be integrated into, and be part of, the existing fuel oil system at the Central System Facility. This project will also serve to reinforce the rather marginal 45 day useable fuel storage supply presently exisiting at the Laboratory. Light feedstock material is received from vendors and stored in existing small capacity (10,000 gallon) receiving tanks. A quality control analysis is conducted for verifying fuel and environmental standards. Acceptable fuel will then pass through the new clarifiers to remove solids, water, etc., and be transferred to one of the new 8,000 barrel storage tanks.

Each storage tank will be connected to the existing fuel oil storage and piping system within the Central Steam Facility with separate supply and return fuel piping. Each tank will be a fixed roof, vertical tank constructed in accordance with API and NFPA tank storage standards. The storage facility will be impounded by an earthen, impervious dike, and all transfer piping will be above ground.

9. Purpose, Justification of Need for, and Scope of Project:

There is insufficient capacity at the tank farm to store non-miscible light feedstocks and for blended alternate liquid fuels for firing the boilers at the Central Steam Facility. Presently, three of the six major storage tanks are used for holding, blending and processing of the various products to make the Alternate Liquid Fuels. The other three (17,300 barrels) represent approximately 42% of the tank farm capacity. The other three tanks (24,300 barrels) are used as day tanks for the finished product of either blended alternate liquid fuels or light feedstocks for direct firing of the boilers. At a nominal winter firing rate of 23,000 gallons of fuel in a 24 hour period, the finished fuel storage capacity represents only a 44 day supply.

In addition, the non-miscible, light feed stock fuels have a Btu content of 80,000 to 110,000 Btu/gallon and, therefore, require approximately 40% greater storage capacity than virgin No. 6 and blended alternate liquid fuel for the same comparable fuel Btu content. These non-miscible light feed stocks represent a significant and as yet untapped resource for Brookhaven's on-going Alternate Liquid Fuels program.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and Location of Project: Fuel Storage Facility
Brookhaven National Laboratory
Upton, N.Y.

2. Project No. 85-A-602

9. Purpose, Justification of Need for, and Scope of Project: (Continued)

The proposed additional tank storage facility will be dedicated to the storage of light feedstocks which will permit the Laboratory to purchase light waste fuels during the Spring, Summer and Fall (non-heating season) when availability is good and prices are lowest. (During the heating season, many generators of these materials consume them in their own boilers, restricting the availability of spot purchases by the Laboratory). Installation of this facility will permit the Laboratory to inventory up to 24,000 barrels of light, non-miscible, feedstocks, thereby allowing the displacement of an additional 17,200 barrels of critical, expensive, imported virgin No. 6 fuel oil. This represents a potential savings of $917,000 annually.

Economic Analysis

The proposed facility has many recognizable and tangible economic factors to justify its approval. A Life Cycle Costing (LCC) analysis based on the expected reduction of critical virgin No. 6 fuel oil was performed in accordance with the NBS Handbook No. 135, revised September 1984 and the November 16, 1981 Federal Register guidelines. A detailed engineering analysis leading to the amount of energy savings, coupled with a present value analysis yields the following Investment Analysis Summary:

INVESTMENT ANALYSIS SUMMARY

Savings to Investment Ratio (SIR)	6.8
Payback Period	2.6 years
Annual Energy Savings	533 Billion Btus
Annual Dollar Savings	$917,000

10. Details of Cost Estimate

Item	(Dollars in Thousands) Item Cost	(Dollars in Thousands) Total Cost
a. Architect-Engineer, design and inspection at approximately 14% of Construction Costs..		$ 250

CONSTRUCTION PROJECT DATA SHEETS

1. Title and Location of Project:	Fuel Storage Facility Brookhaven National Laboratory, Upton, N.Y.	2. Project No. 85-A-602

10. Details of Cost Estimate: * (Continued)

b. Construction Costs			2,100
Site work		$ 123	
8,000 barrel fuel storage tanks	(3 @ $205,000 ea.)	615	
Tank foundations	(3 @ 41,000 ea.)	123	
Centrifuge clarifiers	(2 @ 270,000 ea.)	540	
Fuel transfer pumps	(2 @ 18,000 ea.)	36	
10,000 gallon transfer tank		18	
Piping, supports and accessories		591	
Electrical work		54	
c. Contingency at approximately 15% of above costs			350
Total Costs			$2,700

* Escalation rates conform to the guidelines prescribed in the Department of Energy Field Budget Process Chapter, February 1982, which are based on the materials and labor data contained in the Energy Supply Planning Model and escalation rates forecasted by the Data Resources, Incorporated (DRI). Escalation rates used for FY 1983, 1984, 1985 and 1986 (until midpoint of construction) were respectively 9.6%, 9.0%, 9.9% and 8.5 percent.

11. Method of Performance:

Design and inspection will be performed under a negotiated Architect-Engineer contract. Construction and procurement will be accomplished by fixed-price contracts and purchase orders awarded on the basis of competitive bidding.

12. Funding Schedule of Project Funding and Other Related Requirements:

Not required.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements:

Not required.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
CONSTRUCTION PROJECT DATA SHEETS
ENERGY SUPPLY RESEARCH AND DEVELOPMENT - PLANT AND CAPITAL EQUIPMENT
ENERGY APPLICATIONS
IN-HOUSE ENERGY MANAGEMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

1. Title and Location of Project: Combustion Air Preheaters
Energy Technology Engineering Center
Santa Susana, California

2. Project No. 85-A-604

3. Date A-E work initiated: 2nd Qtr. FY 1986

3a. Date physical construction starts: 2nd Qtr. FY 1986

4. Date construction ends: 2nd Qtr. FY 1987

5.	Previous cost estimate:	$3,300
	Less amount for PE&D	0
	Net cost estimate:	$3,000
	Date: May 1982	
6.	Current cost estimate:	$3,300
	Less amount for PE&D	0
	Net cost estimate:	$3,300
	Date: May 1982	

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1985	$1,400	$1,400	$1,400	$ 300
1986	1,828	1,828	1,828	2,000
1987	72	72	72	1,000

8. Brief Physical Description of Project:

This energy conservation project provides for modifications to the Sodium Components Test Installation, an existing facility at the Energy Technology Engineering Center (ETEC), to reduce the projected facility fuel consumption by addition of a combustion air preheat system to each of the H-1 and H-2 sodium heaters. During steam generation testing at power levels at 70 MWt, stack gas temperature will vary from 700 to 1500 degrees F.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and Location of Project: Combustion Air Preheaters
Energy Technology Engineering Center
Santa Susana, California

2. Project No. 85-A-604

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8. Brief Physical Description of Project: (Continued)

Stack gas will be used to preheat incoming combustion air to 600 degrees F. This project consists of two modifications: One for the H-1 heater; and one for the H-2 heater. The two existing combustion air fans will be removed and replaced by one each forced and induced draft fans. A new stack will be provided. The heater windbox and the burner throat brickwork will be enlarged. The oil and gas burners will be modified. For the H-1 heater, new forced draft and induced fans are required. The existing stack, air entrance plenum, and windbox will be modified. The existing air flow control damper and actuator control system will be relocated. The east and west faces of the heater will be insulated.

9. Purpose, Justification of Need for, and Scope of Project:

Addition of air preheaters to the H-1 and H-2 sodium heaters will reduce fuel consumption by 11%. This amount of energy savings for a 15 year study period yields the following life cycle cost analysis:

Savings to Investment Ratio	3.7
Payback Period	2.4 years
Annual Energy Savings	184 Billion Btus
Annual Dollar Savings	$1,282,000

10. Details of Cost Estimate:

a. Engineering, Design and Inspection		370
Title I Engineering	35	
Title II Engineering	300	
Title III Engineering	35	
b. Land and Land Rights		0

CONSTRUCTION PROJECT DATA SHEETS

1. Title and Location of Project: Combustion Air Preheaters
Energy Technology Engineering Center
Santa Susana, California

2. Project No. 85-A-604

10. Details of Cost Estimate: (Continued)

c. Construction Costs		$2,180
Fans and Drives	400	
Ductwork and Structure	180	
Stack and Stack Penetrations	37	
Burner Modifications	230	
Insulation	360	
Preheaters	300	
Concrete Work	36	
Equipment Relocation	37	
Electrical and I & C	530	
Painting	70	
d. Construction Management, Technical Management and Procurement Services		200
Subtotal		2,750
Contingency at 20%		500
Total project estimate		$3,300

11. Method of Performance:

The Title I and II engineering design will be performed by ETEC. ETEC will provide design of the preheat system, support structures, electrical power, ductwork, control, and associated instrumentation. ETEC will prepare and maintain the system design description. Procurement will be accomplished by ETEC based on competitive bidding. Construction will be performed under competitively bid, fixed-price contracts with ETEC performing construction management and Title III services during construction.

CONSTRUCTION PROJECT DATA SHEETS

1. Title and Location of Project: Combustion Air Preheaters
Energy Technology Engineering Center
Santa Susana, California

2. Project No. 85-A-604

12. Funding Schedule of Project Funding and Other Related Requirements:

Not required.

13. Narrative Explanation of Total Project Funding and Other Related Funding Requirements:

Not required.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
PROGRAM OVERVIEW
TECHNICAL INFORMATION MANAGEMENT PROGRAM

The Department of Energy's (DOE) multi-billion dollar annual research and development (R&D) effort is characterized by over 5,000 research projects carried out on a decentralized basis at over 2,700 diverse sites by more than 40,000 people working in the R&D program. This research generates approximately 40,000 documents reporting on DOE-funded research per year.

The Technical Information Management Program (TIMP) was developed by DOE to manage the results from this extensive research effort by operating a centralized technical information program responsible for collecting these results, managing the processing and access to these results using various information technologies, and disseminating the results to DOE-funded researchers and program managers. This information is also used to obtain on a reciprocal basis comparable research information from foreign countries and to support the Department's international collaborative R&D programs.

The primary goals of TIMP are (1) to ensure cost effective and efficient management, control, and accountability of DOE-funded research results, and (2) to obtain worldwide energy R&D results for use by DOE and U.S. scientists, engineers, and program managers. As part of the overall Departmental program, TIMP is responsible for the management, control, and dissemination of classified and sensitive materials produced in its DOE R&D programs.

Significant recent accomplishments include:

- Expanded international information exchange programs by concluding a bilateral agreement with the United Kingdom, initiating development of a centralized information system with the International Energy Agency (IEA) and proceeding on the development of a bilateral agreement with Japan.

- Continued leadership role in fulfilling existing U.S. obligations to the International Atomic Energy Agency (IAEA), International Energy Agency (IEA), and seven nations with which the U.S. has bilateral agreements in force.

- Continued management of the DOE master file on worldwide energy R&D. This energy database lets program managers, scientists, and engineers determine what research has already been completed before beginning new projects. Almost 200,000 such completed projects or efforts are added to the database each year.

- Implementation of a system which will provide classified research results to authorized users on a nationwide basis utilizing encrypted and secure voice equipment.

- Continued evaluation of the activities of DOE field sites to assure that Departmental technical information policies and procedures are followed.

- Continued monitoring of the receipts of DOE-funded R&D deliverables that ensure contractors meet contract specifications.
- Expanded comprehensiveness of the Research-In-Progress (RIP) database. With this database, DOE researchers determine what research is under way before starting new research projects.
- Completed the reproduction and shipment of all unclassified DOE technical reports published during the period 1976-1986 to 170 Congressionally designated depository libraries.

Objectives for FY 1987

- To fulfill U.S. commitments to international energy agencies and bilateral agreement signatories.
- To continue to manage an effective scientific and technical information facility providing management of and access to R&D results for the DOE research program.
- To introduce more cost-effective and efficient processes into the central Departmental scientific and technical information facility as new technology becomes available and resources permit.
- To improve DOE accountability and reporting procedures for R&D contract deliverables.
- To continue to manage classified and sensitive energy data most effectively in the interest of national security.
- To continue to implement and expand technical information appraisal programs to ensure compliance with Departmental technical information policies and procedures.
- To continue to provide standards, guidance, and support to the DOE technical information management infrastructure.

Accomplishment of the objectives of the centralized Technical Information Management Program is consistent with the Department's responsibilities regarding control, protection, and access to scientific and technical information as stated in 42 U.S.C. 7112, 7151 and 9703, and Executive Orders on national security information. The TIMP will continue to carry out its responsibility in the development and implementation of Departmental policy in the area of scientific and technical energy information exchange and provide a system which will help to minimize costly duplication of effort, protect information affecting national security, and increase scientific productivity.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
TECHNICAL INFORMATION MANAGEMENT PROGRAM
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands)

	FY 1985 Appropriation	FY 1986 Adjusted Appropriation	FY 1987 Base	FY 1987 Request
Technical Information Management Program				
Operating Expenses	$ 12,642	$ 13,072	$ 13,072	$ 13,848
Capital Equipment	800	550	550	850
Subtotal	$ 13,442	$ 13,622	$ 13,622	$ 14,698
Less transfer of prior year unobligated authority from In-House Energy Management:		-1,209	-1,209	-3,923[2/]
Net Budget Authority	$ 13,442	$ 12,413[1/]	$ 12,413	$ 10,775
Total FTEs	175	175	175	175

Authorization: Section 31, P.L. 83-703

[1/] This amount includes $2,791,000 to be reprogrammed from FY 1986 In-House Energy Management funds.

[2/] Reprogrammed from In-House Energy Management.

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer.	Gramm-Rudman-Hollings Reduction	Subtotal	Comparability Adjustments	Adj. Approp. Total
Technical Information Management Prog.					
Operating Expenses	$ 9,200	$ -348	$8,852	$2,791	$11,643
Capital Equipment	800	-30	770	--	770
Total, Technical Information Management Program	$10,000	$ -378	$9,622	$2,791	$12,413
Operating Expenses	$ 9,200	$ -348	$8,852	$2,791	$11,643
Capital Equipment	800	-30	770	--	770

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
TECHNICAL INFORMATION MANAGEMENT PROGRAM
ENERGY SUPPLY RESEARCH AND DEVELOPMENT

(In thousands of dollars)

FY 1986 Adjusted Appropriation	$ 9,622
Plus transfer of prior year unobligated authority from In-House Energy Management	+1,209
Plus obligational authority to be reprogrammed from FY 1986 In-House Energy Management	+2,791
FY 1986 Revised Appropriation	13,622
Built in increases and decreases	0
FY 1987 Base	$13,622
Program Increases and Decreases	
o Increases for within grades and promotions.	+ 80
o Increase for software conversion	+ 301
o Provide for necessary equipment maintenance.	+ 75
o Escalation increases of contractual services.	+ 320
o Provide for necessary upgrade of capital equipment.	+ 300
FY 1987 Request	$14,698
Less prior year unobligated authority from In-House Energy Management	-3,923
Net Authority	$10,775

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
NARRATIVE
TECHNICAL INFORMATION MANAGEMENT PROGRAM
ENERGY SUPPLY RESEARCH AND DEVELOPMENT

The major program responsibilities covered by the funding requirements for the TIMP are:

(1) The development and implementation of specific DOE-wide policies, procedures, and guidelines relating to scientific and technical information (STI).

(2) Program evaluation responsibility to ensure that scientific and technical information policies are effectively carried out.

(3) The management of an international program to allow the U.S. to capitalize on the availability of technical information generated through other nations' energy research and development.

(4) Management of the Technical Information Center, DOE's centralized scientific and technical information facility. This facility is maintained on behalf of all programs to:

   (a) provide management accountability information for DOE-funded information deliverables; and

   (b) make accessible the result of worldwide investment in energy R&D to support research program productivity and ensure that DOE receives the maximum return on its research dollar investment.

The Department's Technical Information Management Program also ensures DOE compliance with legislation establishing the Department of Commerce (NTIS) as the primary distribution center to the U.S. public for federally-funded research and development results and the provision of DOE scientific and technical reports to the nation's depository libraries (15 U.S.C. 1151-57 and 44 U.S.C. 1901-14). Through its TIMP, DOE provides research results to the NTIS for access by U.S. business, industry and the general public, and to GPO's depository libraries. The gross costs of operating the Technical Information Management Program are partially offset by collections from users of its products and services. The program will continue to maximize every opportunity to recover costs.

The major benefits of the program can be grouped into four impact areas:

(1) Research program productivity is increased through cost avoidance and better allocation of resources.

(2) Control and protection of the DOE technology resource in the form of scientific and technical information (STI) is cost-effectively achieved.

(3) DOE management accountability is provided.

(4) DOE and other U.S. funded energy research is exchanged with selected nations on the basis of equity.

Table 1 outlines the major management and control systems which are funded to meet the program responsibilities and to obtain the program benefits.

TABLE 1
TIMP MANAGEMENT AND CONTROL SYSTEMS FOR THE RESULTS OF DOE INVESTMENT IN R&D

Program Control System	Purpose
Technical Information Management System (TIMS)	Provide DOE management with accountability information on contract deliverables.
	Ensure R&D results are reported to the control system.
Research-In-Progress (RIP)	Avoid unnecessary R&D spending by helping to ensure that new procurements do not overlap other research efforts (e.g. FE requires RIP search before any new procurements are made).
	Provide DOE programs with multi-use R&D data.
Policy Development	Reduce ineffective use of information resources (part of effective Information Resources Management as required by P. L. 96-511).
	Comply with laws, treaties, and executive and Departmental orders relating to research information.
Oversight and Program Evaluation	Ensure policy implementation for effective resource management.
DOE Archives for S&T	Provide economies of scale for cost-effective resource management (unique record of over 300,000 DOE reports; used in Defense Program (DP) classification review).
Energy Data Bases	Provide comprehensive access to state of knowledge to avoid duplicative R&D activities (over 2.3 million research records in energy science and technology).
	Provide intelligence base for analysis of other nations' state of the art in energy technologies in the interest of U.S. security as required by Executive Order 12333.
Energy Access and Dissemination Systems	Provide economies of scale and avoid waste by centralization (through online electronic access and current awareness bulletins).
International Information Management	Protect technology and assure favorable exchange when it is to U.S. advantage.
Industrial and Public Access to results of DOE R&D	Facilitate goals of technology transfer to U.S. industry (25,000 reports deposited annually at NTIS). Satisfy laws requiring taxpayer access.
Management and control of DOE Technical Reports	Ensure that contractors produce reproducible and usable products.
	Provide cost effective centralized control of publication distribution (meet requirement of OMB 1-16) for over 20,000 DOE technical reports.

Narrative (Continued)

Of the $14,698,000 program funding available, approximately $6 million is for personal services and personnel benefit costs for 175 full time equivalent employees and the balance is for contractual services and supplies. The increase of $1,076,000 above the FY 1986 program level of $13,622,000 is for the following:

(1) Personal Services and Personnel Benefits ($80,000) - Although staffing level remains constant at 175 for FY 1986 and FY 1987, additional costs will be increased for within grades and promotions.

(2) Software Conversion ($301,000) - All applications on the DECSYSTEM KL-10 computers must be converted over to the VAX cluster in anticipation of the phase-out of the KL-10s in FY 1988. This increase is for the software requirements associated with this change over.

(3) ADP Capital Equipment Maintenance ($75,000) - Increase reflects the need for additional maintenance contracts associated with maintaining both VAX and KL-10 equipment during transition.

(4) Contractual Service Contracts ($320,000) - Increase is based on cost escalation of contractual services.

(5) Capital Equipment ($300,000) - The increase in capital equipment from FY 1986 to FY 1987 is as follows:

	FY 1986 Request	FY 1987 Request
Central Information Management (ADP)		
VAX 8600 System	300	300
VAX Cluster Upgrade	75	150
Magnetic Disk Upgråde	0	80
Terminals and Microcomputers	30	0
IDM Upgrade	25	0
Classified System Upgrade	70	43
Communications Upgrade	0	100
Subtotal	500	673
Non-ADP		
Production Equipment	50	177
Total Capital Equipment	550	850

Justification for the above FY 1987 equipment items:

ADP - Central Information Management Upgrade ($673,000)

As indicated above, all applications on the DECSYSTEM KL-10 computers must be converted over to the VAX cluster. A VAX 8600 must be acquired and the existing VAX cluster upgraded to accommodate the KL-10 workload. The storage capability on the VAX cluster will be augmented to replace the storage capabilities of the

RP06 disk units on the KL-10 system and a second controller will be acquired to increase the fault tolerance of the cluster. Classified system must be upgraded with additional disk and tape drive capability. The communications upgrade will allow the local area network to be expanded to accommodate a greater number of users for access to OSTI computers as well as to the DOE-wide systems for bibliographic and numeric data. As the number of databases available on the system increases and more post-processing applications are made available, the number of users are expected to increase accordingly.

Non-ADP Equipment ($177,000)

The non-ADP funds will be used to replace old inefficient equipment. A folder ($45,000), perfect binder ($125,000), and plate burner ($7,000) will be acquired in order to increase production without additional labor costs and reduce maintenance costs.

The TIMP request of $14,698,000 will support the following activities:

(1) INTERNATIONAL INFORMATION EXCHANGE. TIMP has the lead in special bilateral technical information exchange agreements and programs of the International Energy Agency and the International Atomic Energy Agency. Technical information received through these programs lets DOE researchers review progress on similar or related work in other countries. This often permits them to cut costs or redirect their work in more promising directions.

(2) DEVELOPMENT OF POLICIES, PROCEDURES, AND GUIDELINES. TIMP must implement responsibilities under DOE Order 1430.1 so that the results of the Department's R&D program in the form of technical information is managed effectively.

(3) OVERSIGHT AND APPRAISAL. In order to assure that all research sites fulfill their contractual reporting responsibilities to DOE, TIMP is responsible for a Department-wide oversight and appraisal program.

(4) DEVELOPMENT OF THE ENERGY DATABASE (EDB). TIMP will continue to maintain a central database of energy science and research findings for DOE researchers.

(5) MANAGEMENT OF DEFENSE AND SENSITIVE TECHNICAL INFORMATION. TIMP will continue to maintain secured facilities and systems and qualified staff to manage and control the results of DOE classified R&D.

(6) MANAGEMENT OF DOE TECHNICAL RESEARCH RESULTS. As a result of its R&D effort, DOE disseminates research findings in over 25,000 original technical reports each year. TIMP has the responsibility to acquire these results, distribute them to the appropriate users, and then maintain effective access for future use as well as for historical program documentation. Records of this material as well as subject access are put in machine-readable files, and those of substantial technical value are added to the Energy Database. Over 32,000 DOE-funded publications including journal articles, monographs and conference proceedings are also accessible through its centralized

database system. To reduce costs, microfiches will be substituted in many cases for prime contractor R&D reports previously provided in full-size text.

(7) ACCESS TO UNCLASSIFIED ENERGY R&D RESULTS. TIMP provides access to the technical information it manages by subsetting the Energy Database (EDB) into 300 significant areas of science and technology corresponding to DOE's R&D program disciplines and then providing detailed subject access to EDB using over 24,000 specialized technical subject terms. TIMP has provided for online electronic access to the EDB through commercial vendors and to technical information management files via TIMP computers.

(8) DEVELOPMENT OF RESEARCH-IN-PROGRESS (RIP) DATABASES. The RIP database is DOE's central file on new and ongoing research programs and projects funded throughout the Department. Through computerized online access, this information is available in a timely manner. The availability of this information discourages unnecessary duplication in energy R&D. As a result of cooperative efforts with the Electric Power Research Institute (EPRI) as well as through interagency and bilateral international agreements, TIMP has been receiving notifications of non-DOE energy research in progress which are also being made available to DOE through online electronic access facilities. RIP databases now contain over 10,000 DOE energy project summaries and over 15,000 from other domestic organizations and foreign countries.

(9) MANAGEMENT OF THE TECHNICAL INFORMATION MONITORING SYSTEM (TIMS). TIMP operates an R&D contract monitoring and control system to help ensure that research contract deliverables are received by the Department and made available to appropriate audiences. The system utilizes information contained in the Department's procurement system (PADS) and the reporting requirements specified in individual contracts and grants and compares these requirements against the contract deliverables actually received at OSTI.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
POLICY AND MANAGEMENT - ENERGY RESEARCH
ENERGY SUPPLY RESEARCH AND DEVELOPMENT

(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
Policy and Management - Energy Research Operating Expenses......	$ 530	$ 84	$ 84	$ 550	$+ 466
Total....................	$ 530a/	$ 84a/b/	$ 84	$ 550a/	$+ 466
Staffing Total FTE's.....	8	8	8	8	

a/ Totals reflect a reduction of $3,000 in FY 1985, $4,000 in FY 1986, and $5,000 in in FY 1987 for management initiative savings.

b/ Total reduced by $3,000 in accordance with P.L. 99-177, the Balanced Budget and Emergency Deficit Control Act of 1985 (Gramm/Rudman/Hollings). Also, general reduction of $412,934 to be offset by use of prior years carryover.

Authorization: Section 209, P.L. 95-91.

DEPARTMENT OF ENERGY
1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
POLICY AND MANAGEMENT - ENERGY RESEARCH

(In thousands of dollars)

1986 Appropriation enacted..	$ 87
1986 Gramm-Rudman reduction...	- 3
1986 adjusted...	84
Program increases and decreases:	
o Funding required to maintain FTE level................................	+ 466
1987 budget request	$ 550

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer. (1)	General Reduction (2)	Management Initiatives (3)	Pay Cost Restoration (4)	FTE General Reduction (5)	Gramm-Rudman-Hollings (6)	ES&H Transfer/ Reprogramming (7)	Subtotal (8)	Comparability Adjustments (9)	Total (10)
Policy and Management - (ER)										
Operating Expenses	$ 500	$ -413				-3		84		84
Subtotal, Policy & Management.	500	-413				-3		84		84
General Reduction	-413	413								
Management Initiatives										
Pay Restoration										
Use of Prior Year Balances (P&M,ER)										
Use of Prior Year Balances (Other Energy Supply)										
Total, Policy & Management (ER)	87	–				-3		84		84

Policy and Management - Energy Research

The FY 1987 request for Policy and Management - Energy Research is $550,000. These funds are required to provide for personnel and other costs associated with continuation of eight full-time equivalents in the Office of the Director of Energy Research.

This staff directs the Office of Energy Research responsibilities carried out under the following specific programs: High Energy Physics; Nuclear Physics; Biological and Environmental Research; Magnetic Fusion Energy; Basic Energy Sciences; Energy Oversight, Research Analysis and University Support; Multiprogram Energy Laboratories-Facilities Support; and University Research Instrumentation.

In addition to directing the Office's research programs, the Director, Energy Research, also serves as the Department's principal science advisor in formulating basic research policy. In this capacity, the Director provides independent reviews, analyses and recommendations concerning a wide range of activities which require scientific counsel. These activities include, for example, national research and development strategies, plans and policies, including the establishment of budgetary priorities for energy research and development programs. They also include advising on policy issues regarding the best utilization of the nonweapons multipurpose laboratories assigned to Energy Research for oversight and management. These responsibilities are carried out through meetings with top management and program officials as necessary throughout the year; interactions with laboratories; presentations to the Energy Research Advisory Board; participation in Congressional hearings; and interactions with the scientific community. This staff is also responsible for implementing uniform systems and procedures for overall coordination and management of ER's continually increasing international activities which represent a significant workload and a very substantial investment of ER resources.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
NUCLEAR
ENERGY SUPPLY RESEARCH AND DEVELOPMENT
(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Appropriation	FY 1986 Appropriation	FY 1987 Base	FY 1987 Request	Request vs Base
Policy and Management (NE)					
Operating expenses	$ 1,323[1/]	$ 1,732[2/]	$ 1,732	$ 1,810	$ +78
Total	$ 1,323	$ 1,732	$ 1,732	$ 1,810	$ +78
Staffing	31[3/]	24	24	15	-9

Authorization: Section 31, P.L. 83-703

[1/] Reflects a reduction of $150,000 for management initiatives and $50,000 for Advanced Data Processing reductions.

[2/] Adjustments to the FY 1986 appropriation are shown on the table on the following page.

[3/] Reflects actual Full Time Equivalent (FTE) usage versus allocation of 24 FTE.

SUMMARY OF CHANGES
POLICY AND MANAGEMENT (NE)
(In thousands of dollars)

FY 1986 Budget Appropriation	$ 1,732
- Decrease of nine support personnel	-315
- Severance pay	+285
- Increase in computer support	+108
FY 1987 Budget Request	$ 1,810

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Confer.	Gramm-Rudman-Hollings	Total
Policy and Management - (NE)			
Operating Expenses	$1,800	$-68	$1,732
Subtotal, Policy & Management (NE)	$1,800	$-68	$1,732
Operating	$1,800	$-68	$1,732

Department of Energy
FY 1987 CONGRESSIONAL BUDGET REQUEST
(tabular dollars in thousands)
Policy and Management

Narrative Justification

The major change from FY 1986 to FY 1987 is the reduction of nine Full Time Equivalent's (FTE's). This action requires a reduction of support personnel with the corresponding savings in salaries and benefits. This reduction, however, is offset in part by required severance pay for these employees. A minimal increase in computer support is also required.

The objective of the Policy and Management activity is to provide adequate staffing and financial resources for the Assistant Secretary, Nuclear Energy (NE), and the supporting functions of policy development, plans formulation, resource management, and program assessment.

Staffing provides the technical and management expertise needed to direct and administer varied R&D and operational programs encompassing both civilian and defense activities. These efforts require the combined skills of technical managers, administrators, and clerical staff. The R&D activities encompass different technologies, at various stages of development, and are performed at different contractor locations to include national laboratories, universities, industrial concerns, and foreign governments. The operational activities involving uranium enrichment are also performed at decentralized locations. Defense activities include the Naval Reactors development program at Pittsburgh, Pennsylvania; Schenectady, New York; and Idaho Falls, Idaho.

The funding provides financial resources (i.e., salary, benefits, travel, etc.) to enable the Assistant Secretary and the office staff to perform the requisite functions of the organization. The required funds will permit performance of program and policy reviews at contractor or field office locations, interaction with the Congressional, OMB, and other Departmental elements, involvement with nuclear energy source selection boards, attendance at public meetings either sponsored by the Department or others, furtherance of employee development, and participation in the employment cycle. This latter effort includes invitational travel and change of station orders. With respect to change of station, the requested funds cover employee and family transportation costs, per diem costs, and temporary quarters costs. Computer acquisition and operations support are also covered.

FY 1986 Appropriation	Departmental Request
$ 1,732	$ 1,810

General Management: (7 FTE) This level supports positions required for the Assistant Secretary (AS), the principal Deputy Assistant Secretary (DAS) and their immediate staff.

Program Support: (8 FTE) Provides for staffing in the following principle areas.

> Plans and Evaluation: (4 FTE) Provides professional and clerical staff needed for the development of plans and strategy in the nuclear sector, the preparation of testimony and special correspondence, the analysis of legislation, and the coordination of the program planning efforts. The Office also supports computer acquisition and operation support. Although computer acquisition is nearing completion, the need to maintain this equipment and to produce software packages to optimize their application to a wide range of Nuclear Energy requirements results in increased near term funding.

Resource Management: (4 FTE) Supports such overall management activities as personnel, budget formulation, budget execution, administrative management of funds, procurement, and contract administration, business management, and program/project management, including major systems acquisition, cost estimating, and project reviews. Overall ASNE training is also supported.

The funding of $1,810,000 is comprised of $950,000 for personnel compensation, $100,000 for benefits, $285,000 for benefits for former personnel, $75,000 for travel, and $400,000 for contractual services for computer acquisition and support.

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL REQUEST
LEAD TABLE
POLICY AND MANAGEMENT
Energy Supply Research and Development - Operating Expenses
(Tabular dollars in thousands. Narrative material in whole dollars.)

	FY 1985 Approp.	FY 1986 Adj. Approp.	FY 1987 Base	FY 1987 Request	Request vs. Base
Energy Supply R&D					
Operating Expenses	$ 1,527	$ 1,681	$ 1,681	$ 1,527	-154
Total	$ 1,527	$ 1,681	$ 1,681	$ 1,527	-154
Staffing Total FTEs	19	14	14	14	0

Authorization: Section 209 P.L. 95-91, "Department of Energy Organization Act."

Department of Energy

FY 1987 Congressional Budget Request

Adjustments to FY 1986 Appropriations

	FY 1986 Conference	General Reduction	Pay Cost Restoration	FTE General Reduction	Gramm-Rudmam-Hollings Reduction	Subtotal	Comparability Adjustments	Adj. Approp. Total
Policy and Management - (CE) (ESR&D)								
Operating Expenses	$1,800	$ -41	$ -51	$ -10	$ -68	$1,630	$ 51	$1,681
General Reduction	-41	+41	---	---	---	---	---	---
FTE Reduction	-10	---	---	10	---	---	---	---
Pay Restoration	-51	---	51	---	---	---	---	---
Use of Prior Year Balances (P&M,CE)	51	---	---	---	---	51	-51	---
Total, Policy & Management (CE)	$1,749	$ ---	$ ---	$ ---	$ -68	$1,681	$ ---	$1,681

DEPARTMENT OF ENERGY
FY 1987 CONGRESSIONAL BUDGET REQUEST
SUMMARY OF CHANGES
POLICY AND MANAGEMENT
(In Thousands of Dollars)

FY 1986 Adjusted Appropriation	$1,681
Reduced level of support	-154
FY 1987 Congressional Request	$1,527

Policy and Management	$1,527,000

The Policy and Management FY 1987 Congressional Request is $1,527,000 and 14 full time equivalent staff years of effort which provides for overall management guidance to Conservation and Renewable Energy (CE) programs. Staffing levels provide the executive and overall program direction for all CE programs to ensure effective management. These activities include executive management, policy formulation, program review and approval, and liaison with senior officials in DOE, White House, Congressional, OMB, other Departmental Agencies, private industry, and State and local governments. In addition, the staff will carry out analyses of the CE programs needed to assess performance and effectiveness.

The FY 1987 request also provides for the support for functions such as planning, policy development and analysis, program planning and evaluation, budget preparation and execution, program and personnel management and administrative support performed by the Offices of the Assistant Secretary and Policy and Management. Activities performed include development of planning guidance, analysis of program options for achieving planned objectives, evaluation of performance against program objectives, handling and/or coordination of program/budget submissions and execution of approved budgets and ongoing support functions in the areas of: administrative services, procurement, personnel, space management and related support services. In addition, funds are included for the continuation of a procurement tracking system and an automated support system which provides text processing, electronic mail, data base management, communication and other program applications.